

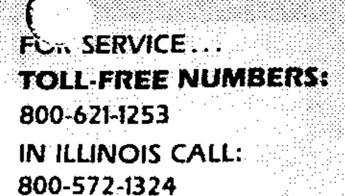
16-3016-103
February 15, 1984



DRAWING SET

including ...

- block diagrams
- schematics
- assembly diagrams
- parts information

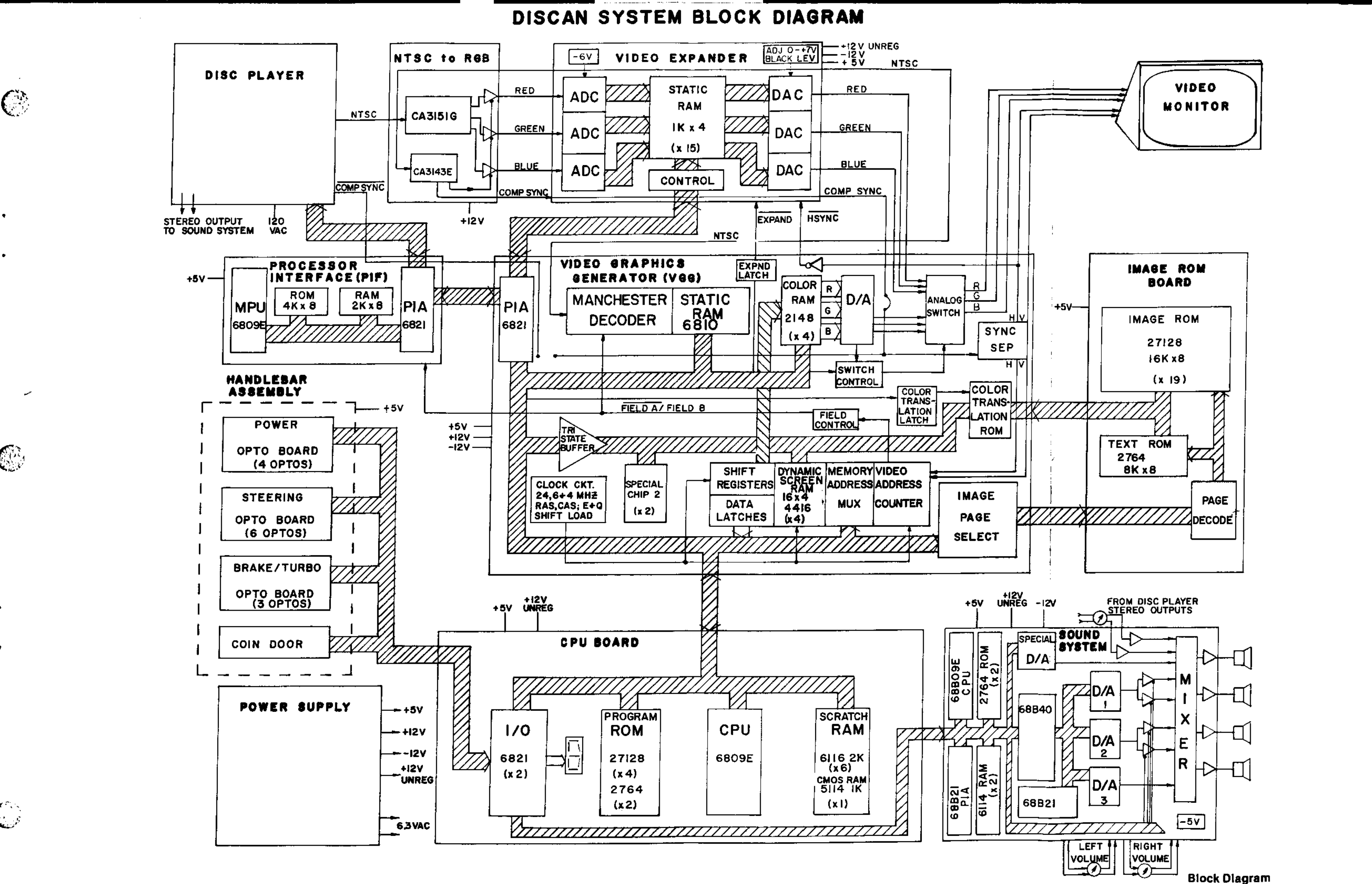


FOR SERVICE . . .
TOLL-FREE NUMBERS:
800-621-1253
IN ILLINOIS CALL:
800-572-1324



3401 N. California Av.
Chicago, IL 60618
(312) 267-2240

DISCAN SYSTEM BLOCK DIAGRAM



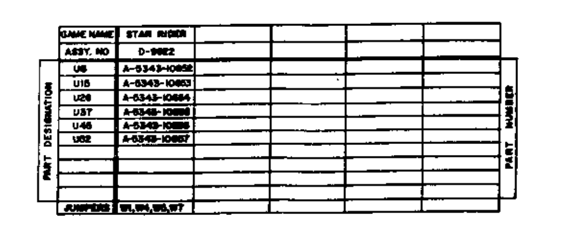
Block Diagram

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
67	—			—
66	5700-08985-00		SOCKET, I C 40 PIN	1
65	5700-10176-00		SOCKET, I.C. 28 PIN	6
64	—			—
63	5791-09083-00	J3, J5	CONNECTOR, 12H2391 09-65-1121	2
62	5791-09444-00	J4, J7	CONNECTOR, 18H2391 09-65-1181	2
61	5791-09027-00	J2	CONNECTOR, 9H2391 09-65-1091	1
60	5791-09497-00	J6	CONNECTOR, 7H2391 09-75-1071	1
59	5791-10027-00	J1	CONNECTOR, 64 PIN MALE.	1
58	—			—
57	5641-09371-00	SW1	SWITCH, P SPDT 115V, .25A	0
	5641-09312-00		SWITCH, P DPDT 100V, 5A.	1

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
56	5881-09021-00	—	BATTERY HOLDER #17	1
55	5880-09022-00	BAT.1, BAT2, BAT3	BATTERY, 1.5V AA ALK.	3
54	—			—
53	5075-09018-00	Z1	ZN., 1N5996A 6.8 V .5W	1
52	5070-09266-00	D3	DIODE, 1N5817 1.0 A	1
51	5070-06258-00	D2	DIODE, 1N4001 1.0 A	1
50	5070-08919-00	D1, D4, D5	DIODE, 1N4148 .5A	3
49	—			—
48	5190-09016-00	Q2	TRANSISTOR, 2N4403 PNP	0
	5190-10270-00		TRANSISTOR, 2N3906 PNP	0
	5190-10390-00		TRANSISTOR, 2N4126 PNP	1
47	5160-08938-00	Q1, Q3, Q4, Q5, Q6	TRANSISTOR, 2N4401 NPN	0
	5160-10269-00		TRANSISTOR, 2N3904 NPN	0
	5160-10389-00		TRANSISTOR, 2N4124 NPN	5
46	—			—
45	5551-09822-00	L1	INDUCTOR, 4.7 UH 3A	1
44	—			—
43	5043-08980-00	C6, C7, 8	CAPACITOR, .01 M 50V +80/-20	45
42	5043-09845-00	C2, C3, C4, C8, C9	CAPACITOR, 1KP 50V +/-20 A	5
41	5040-09545-00	C5	CAPACITOR, 22 M 10V + /-20	1
40	5040-09421-00	C1	CAPACITOR, 100 M 25V +50/-10	1
39	—			—
38	5060-10396-00	SRC2	SIP, 4.7 K OHM & 470 PF 8R & 8C	1
37	5060-10324-00	SRC1	SIP, 1K OHM & .001 MF 8R & 8C	1
36	5019-09786-00	SR2	SIP, 4.7K OHM 5R 6 5%	1
35	5019-10587-00	SR1	SIP, 18K OHM, 9R 10 5%	1
34	—			—
33	5010-09034-00	R6, R41	RESISTOR, 10K OHM 5% 1/4 W	2
32	5010-08991-00	R17, R7, R18, R35	RESISTOR, 4.7K OHM 5% 1/4 W	4
31	5010-09358-00	R1, R2, R8, R27, R29, R34, R33, R31, R40	RESISTOR, 1K OHM 5% 1/4 W	9

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
30	5010-10003-00	R39	RESISTOR, 390 OHM 5% 1/4 W	1
29	5010-09224-00	R9 THRU R16	RESISTOR, 270 OHM 5% 1/4 W	8
28	5010-09160-00	R30, R32	RESISTOR, 220 OHM, 5% 1/4 W	2
27	5010-10171-00	R38	RESISTOR, 56 OHM, 5%, 1/4W	1
26	5010-10176-00	R28	RESISTOR, 47 OHM, 5%, 1/4 W	1
25	5010-09039-00	R36	RESISTOR, 10 OHM, 5%, 1/4 W	1
24	—			—
23	—			—
22	5430-08972-00	U10, U20	I.C., 6820/21 PIA	2
21	5400-09490-00	U46	I.C., MPU. 6809E	1
20	5671-09411-00	U3	DSPL. LED 7 SEG.	1
19	5340-09689-00	U9	RAM/S 5514 1Kx4 C	1
18	5340-09878-00	U14, U25, U36, U44, U51	RAM/S 2016 2K x 8	5
17	5281-09486-00	U16	I.C., 74LS374	1
16	5281-09308-00	U45, U50	I.C., 74LS245 TRNCV	2
15	5281-09867-00	U41, U42, U48, U49	I.C., 74LS244 OCT. BUF	4
14	5281-10043-00	U35	I.C., 74LS175	1
13	5281-09735-00	U22	I.C., 74LS161 BIN CTR	1
12	5281-09246-00	U27	I.C., 74LS139 2-4 DEC.	1
11	5281-09745-00	U24, U28	I.C., 74LS138 DMLTPX	2
10	5281-09737-00	U32	I.C., 74LS86 QUAD XOR	1
9	5281-09487-00	U47	I.C., 74LS74 DUAL D F/F	1
8	5281-09500-00	U5, U13, U19	I.C., 74LS32 QUAD OR	3
7	5280-09551-00	U11	I.C., 7425 DUAL NOR.	1
6	5281-10014-00	U17, U29	I.C., 74LS20 NAND 4IP	2
5	5281-09743-00	U33	I.C., 74LS08 QUAD AND.	1
4	5281-09215-00	U1, U2, U18	I.C., 74LS04 HEX. INV.	3
3	5281-09247-00	U34	I.C., 74LS02 QUAD NOR	1
2	5281-09499-00	U4, U12, U23, U38	I.C., 74LS00 QUAD NAND	4
1	5770-10362-00		BARE P.C. BOARD	1

NOTES: 1. 'B' INDICATES BYPASS CAPACITORS.
2. '*' INDICATES PIN CUT FOR KEYING.
3. 'x' INDICATES PIN 1 OR EMITTER (E)



GAME NAME	STAR RIDER				
ASSY. NO	D-9822				
U8	A-5343-10852				
U15	A-5343-10853				
U26	A-5343-10854				
U37	A-5343-10855				
U46	A-5343-10856				
U52	A-5343-10857				
JUMPERS	W1, W4, W5, W7				

ITEM	PART NUMBER	DO NOT SCALE WORK TO DIMENSIONS SHOWN	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR Don Drygalski			REMOVE BURRS - BREAK SHARP EDGES					

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618

NAME: 3016 CPU SCHEMATIC

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ±.005 FILLETS .020 MAX
MATERIAL

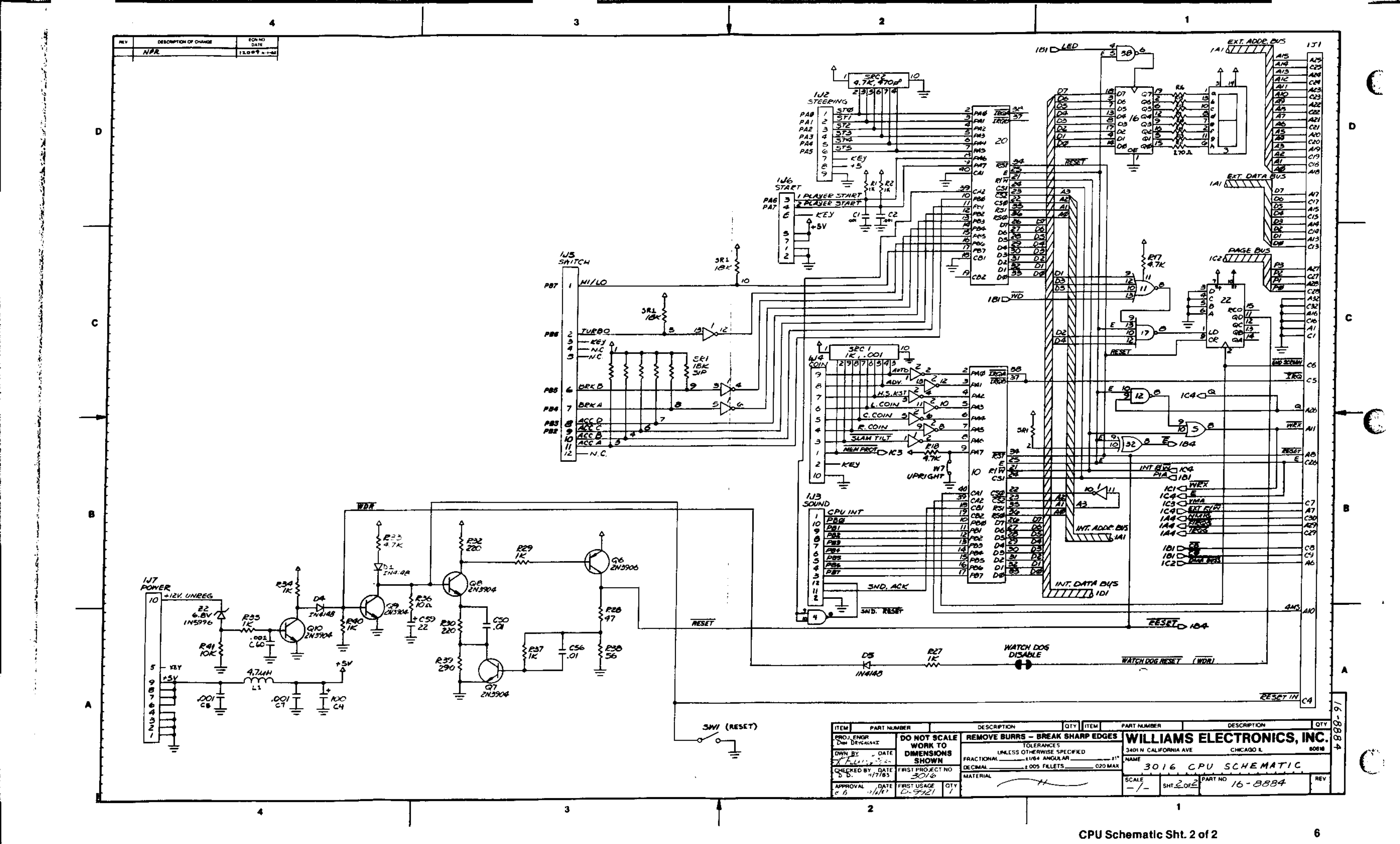
DWN BY — DATE
CHECKED BY D.D. DATE 11/7/83
APPROVAL C.B. DATE 11/8/83
FIRST PROJECT NO 3016
FIRST USAGE D-9921 QTY 1

SCALE -/- SHT 1 OF 2 PART NO 16-8884 REV

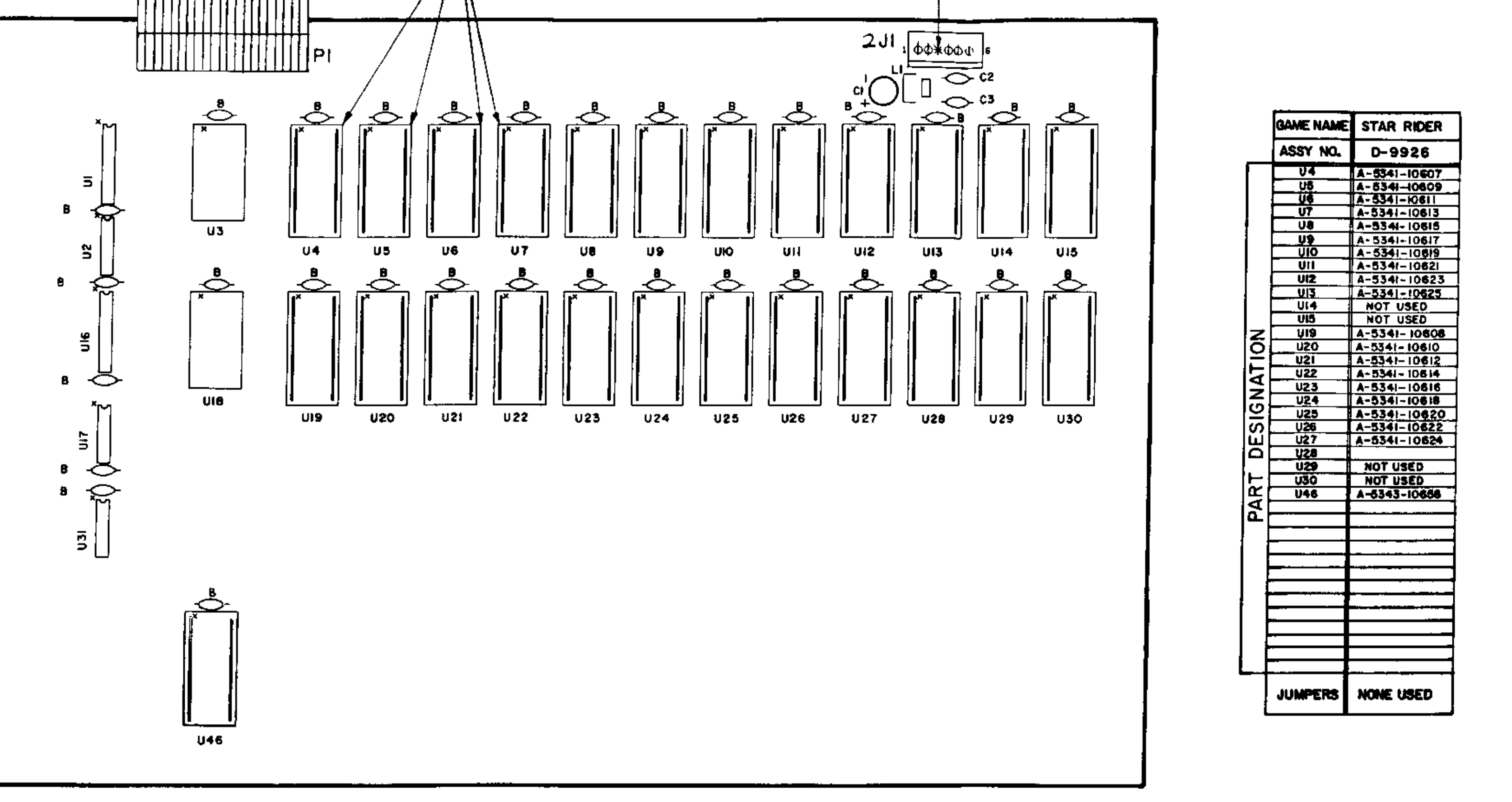
16-8884

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	12-7-83

CPU Schematic Sht. 1 of 2



CPU Schematic Sht. 2 of 2

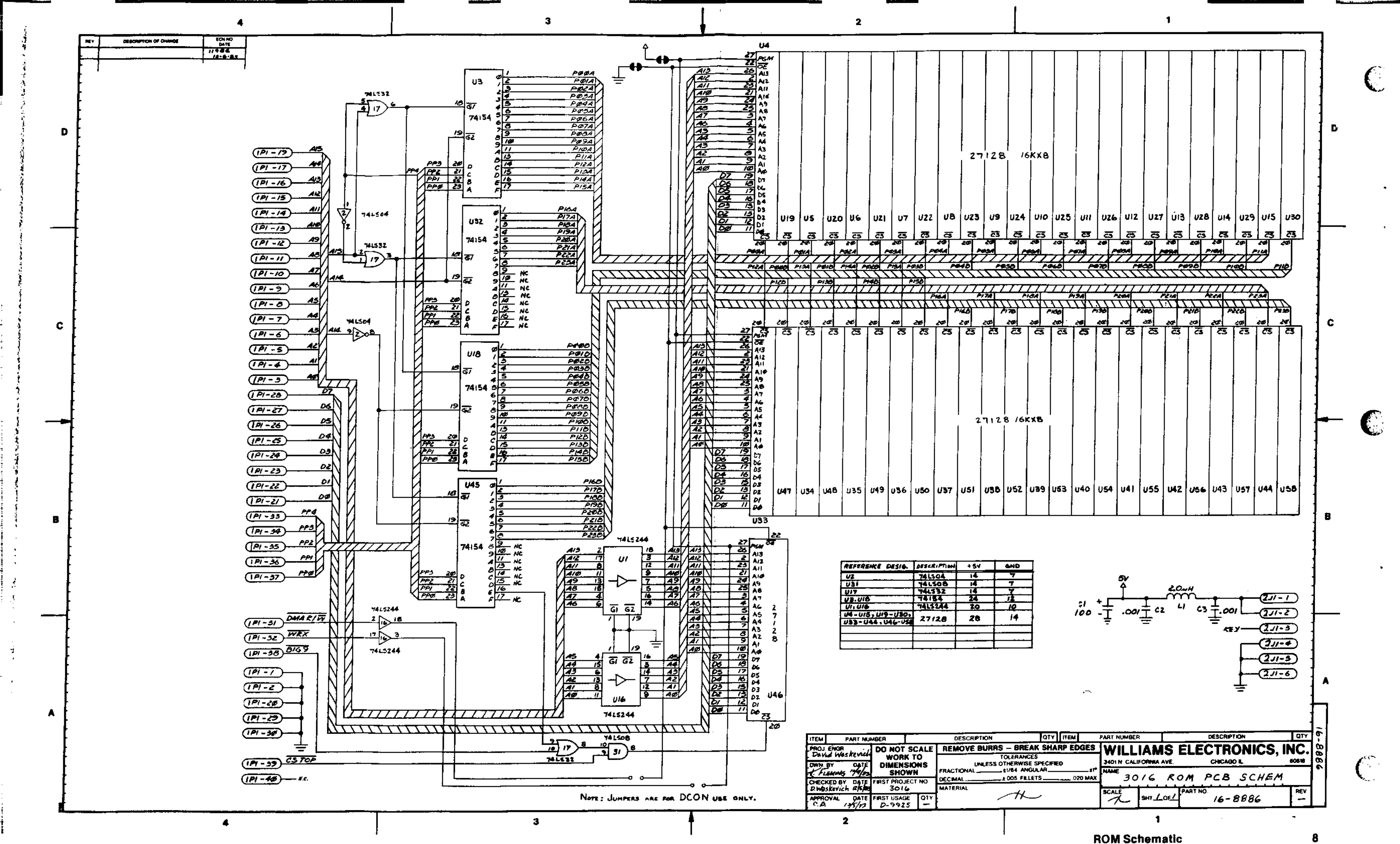


NOTE:
1. FOR SCHEMATIC REFER TO DWG# 16-8886

GAME NAME	STAR RIDER
ASSY NO.	D-9926
PART DESIGNATION	
U4	A-5341-10607
U5	A-5341-10609
U6	A-5341-10611
U7	A-5341-10613
U8	A-5341-10615
U9	A-5341-10617
U10	A-5341-10619
U11	A-5341-10621
U12	A-5341-10623
U13	A-5341-10625
U14	NOT USED
U15	NOT USED
U19	A-5341-10608
U20	A-5341-10610
U21	A-5341-10612
U22	A-5341-10614
U23	A-5341-10616
U24	A-5341-10618
U25	A-5341-10620
U26	A-5341-10622
U27	A-5341-10624
U28	
U29	NOT USED
U30	NOT USED
U46	A-5343-10656
JUMPERS	NONE USED

ITEM	PART Nº	PART DESIGNATION	DESCRIPTION	QTY
16	5795-09352-00	P1	RIBBON CABLE ASSY., 40 PIN, 3"	1
15	5791-09038-00	J1	6-PIN HEADER 09-65-1061	1
14	-/-			-/-
13	5043-09845-00	C2, C3	CAPACITOR, .001 MFD, 50V, ± 20%	2
12	5043-08980-00	BYPASS (8)	CAPACITOR, .01 MFD, 50V, +80-20%	32
11	5040-09421-00	C1	CAPACITOR, 100 MFD, 25V, +50-10%	1
10	-/-			-/-
9	5551-10161-00	L1	INDUCTOR 20μH, 3A	1
8	5700-10176-00		SOCKET 28-PIN IC	25
7	-/-			-/-
6	5281-09867-00	U1, U16	IC 74LS244 OCTAL BUFFER	2
5	5280-09010-00	U3, U18	IC 74154 4-16 LINE DECODER	2
4	5281-09500-00	U17	IC 74LS32 QUAD OR	1
3	5281-09743-00	U31	IC 74LS08 QUAD AND	1
2	5281-09215-00	U2	IC, 74LS04 HEX INVERTER	1
1	5771-10364-00		BARE P.C. BOARD ROM	1

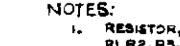
D-9926 Rom Assembly

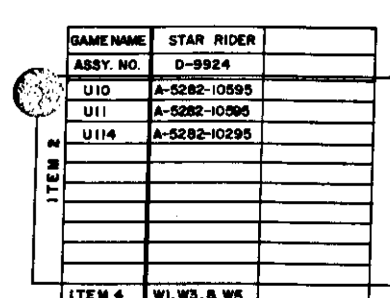


ROM Schematic

NOTES:

1. RESISTOR, 4.7K OHM 1/4 W
   R1, R2, R3, R4, R5, R6, R7, R8, R9, R11, R63
2. CAPACITORS, .001 UF
   C4, C5, C6, C7, C8, C9, C10, C11, C14, C15.
3. TRANSISTORS, 2N3904
   Q1, Q3, Q5, Q6, Q7, Q9, Q10, Q12, Q13, Q16, Q17, Q18,
4. DIODES, 1N4148
   D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25.
5. I.C.S, 74LS161
   U3, U20, U53, U63, U64, U67, U68, U69, U79, U91, U92, U106, U119.
6. I.C.S, 74LS244
   U6, U9, U28, U31, U44, U45, U58, U62, U95, U108.





GAME NAME	STAR RIDER	
ASSY. NO.	D-9924	
U10 (ITEM 2)	A-5282-10595	
U11 (ITEM 2)	A-5282-10596	
U114 (ITEM 2)	A-5282-10295	
ITEM 4	W1, W3, & W5	

ITEM	PART NO	PART DESIGNATION	DESCRIPTION	QTY.
Ⓐ 103	5046-10660-00	C12 (SEE NOTE 7)	CAPACITOR, .022 mf 5% POLYSTYRENE	1
102	5013-10651-00	R12	RESISTOR, 3.3 K OHM 1/4 W 2%	1
101	—/—			—/—
100	5700-10389-00		18 PIN SOCKET	2
99	5700-09006-00		16 PIN SOCKET	1
98	—/—			—/—
97	5521-10318-00	CR1	OSC., 24 MHZ .1%	1
96	—/—			—/—
95	5791-09497-00	J2, J3	7 PIN MOLEX	2
94	5791-09074-00	J4, J6	15 PIN MOLEX	2
93	5791-09444-00	J5	10 PIN MOLEX	1
92	5791-10634-00	J7	40 PIN RIBBON HEADER	1
91	5792-10026-00	J1	64 PIN DIN (FEMALE)	1

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
90	—/—			—/—
89	5281-09746-00	U22	I.C., 74LS368 Hex Inverter	1
88	5281-09486-00	U23, U34, U115, U126	I.C., 74LS374 D Flip Flop 3 State	4
87	5283-10470-00	U101	I.C., 74F374 D Flip Flop 3 State	1
86	5281-09856-00	U27, U43, U57	I.C., 74LS373 Transparent Latch	3
85	5281-10479-00	U50, U109	I.C., 74LS279 Set/Reset Latch	2
84	5281-09308-00	U16, U112, U125	I.C., 74LS245 Octal Bus Transceiver	3
83	5281-09867-00	SEE NOTE 6	I.C., 74LS244 Octal Driver	10
82	5281-09733-00	U12, U13	I.C., 74LS174 Hex D Flip Flop	2
81	5280-09668-00	U8, U24, U40, U54	I.C., 74166 8 bit Serial In/Parallel Out Shift Register	4
80	5281-10447-00	U38	I.C., 74LS164 8 bit Serial In/Parallel Out Shift Reg.	1
79	5281-09735-00	SEE NOTE 5	I.C., 74LS161 4 bit Binary Counter	13
78	5281-09758-00	U4, U21, U78	I.C., 74LS157 2 input Mux,	3
77	5280-09010-00	U39, U80, U110	I.C., 74154 4 to 16 Decoder	3
76	5280-09481-00	U70, U71, U72, U73	I.C., 74153 4 input Multiplexer	4
75	5281-09246-00	U86, U89	I.C., 74LS139 1 of 4 Decoder/DeMux	2
74	5281-09745-00	U35	I.C., 74LS138 1 of 8 Decoder/DeMux	1
73	5281-09737-00	U49	I.C., 74LS86 Exclusive OR	1
72	5281-09855-00	U59, U60, U61, U75, U76, U77	I.C., 74LS85 4 bit Mag. Comparator	6
71	5281-09487-00	U32, U88, U104, U111, U116, U117, U123	I.C., 74LS74 D type Flip Flop	7
70	5282-10190-00	U103, U124	I.C., 74S74 D type Flip Flop	2
69	5280-09309-00	U34	I.C., 7407 Buffer	1
68	5280-09551-00	U107	I.C., 7425 DUAL NOR	1
67	5281-09500-00	U1, U46, U47, U52, U66, U93, U100, U127	I.C., 74LS32 2 input OR	8
66	5281-10014-00	U14, U81, U105	I.C., 74LS20 4 input NAND	3
65	5281-09851-00	U84	I.C., 74LS14 Hex Schmitt Trigger	1
64	5281-09235-00	U18, U33, U82	I.C., 74LS10 3 input NAND	3
63	5281-09743-00	U19, U87	I.C., 74LS08 AND	2
62	5281-09215-00	U17, U37, U48, U83, U120	I.C., 74LS04 Hex Inverter	5
61	5281-09247-00	U15, U36, U65, U121	I.C., 74LS02 NOR	4

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
60	5283-10551-00	U113	I.C., 74F00 NAND	1
59	5281-09499-00	U2, U51, U90, U102, U118, U122	I.C., 74LS00 NAND	6
58	5340-10018-00	U96, U97, U98, U99	I.C., 2148 RAM	4
57	5310-10438-00	U85	I.C., 4049 UB Hex Inverter	1
56	5340-10344-00	U25, U26, U41, U42, U55, U56	I.C., 4416 D-RAM	6
55	A-5410-10083	U29, U30	I.C., DMA (NON-INVERTING)	2
54	5340-09003-00	U5	I.C., 6810 Static Ram	1
53	5430-08972-00	U7	I.C., 6821 PIA	1
52	A-5282-10637	U74	I.C., H PROM (HMI-6349-2)	1
51	—/—			—/—
50	—/—			—/—
49	5551-10161-00	L2, L3	COIL, 2 UH	2
48	5551-09822-00	L1	COIL 4.7 UH 3A	1
47	—/—			—/—
46	5070-06258-00	D26	DIODE, 1N4001	1
45	5070-08919-00	SEE NOTE 4	DIODE, 1N4148	25
44	—/—			—/—
43	5190-10270-00	Q4, Q8, Q11, Q14, Q15	TRANSISTOR, 2N3906	5
42	5160-10269-00	SEE NOTE 3	TRANSISTOR, 2N3904	12
41	—/—			—/—
40	5040-09421-00	C1, C2, C3	CAPACITOR, 100 UF RADIAL	3
39	5041-09163-00	C17	CAPACITOR, 2.2 UF TANT	1
38	5041-09031-00	C20	CAPACITOR, 1 UF TANT	1
37	5043-08996-00	C21	CAPACITOR, .1 UF	1
36Ⓐ	5043-08980-00	8	CAPACITOR, .01 UF	68
35	5043-09845-00	SEE NOTE 2	CAPACITOR .001 UF	10
34	5043-09065-00	C18, C19	CAPACITOR, 470 PF	2
33	5043-09492-00	C16	CAPACITOR, 100 PF	1
32	—/—			—/—
31	5016-10419-00	R58, R59, R60, R61	RESISTOR, 500 OHM VARIABLE	4

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
30	5019-09786-00	SR3, SR5, SR6, SR7, SR8	SIP 4.7K 5R	
29	5019-09362-00	SR1, SR4	SIP 4.7K 9R	
28	5019-09669-00	SR2	SIP 1K 9R	
27	5010-08846-00	R66,	RESISTOR, 220K OHM 1/4 W	
26	5010-10271-00	R16	RESISTOR, 110K OHM 1/4 W	
25	5013-10548-00	R77	RESISTOR, 20K OHM 1/4 W 2%	
24	5010-09034-00	R13	RESISTOR, 10K OHM 1/4 W	
23	5013-10545-00	R26, R30, R34, R38	RESISTOR, 8.2K OHM 1/4 W 2%	
22	5010-10000-00	R15	RESISTOR, 3.9K OHM 1/4 W	
21	5010-08991-00	SEE NOTE 1	RESISTOR, 4.7K OHM 1/4 W	
20	5013-10543-00	R27, R31, R35, R39	RESISTOR, 3.9K OHM 1/4 W 2%	
19	5010-10256-00	R10	RESISTOR, 2.4K OHM 1/4 W	
18	5010-08998-00	R65	RESISTOR, 2.2K OHM 1/4 W	
17	5010-10205-00	R28, R32, R36, R40, R62	RESISTOR, 2K OHM 1/4 W 2%	
16	5010-09117-00	R42	RESISTOR, 1.8K OHM 1/4 W 2%	
15	5013-10635-00	R43	RESISTOR, 1.6K OHM 1/4 W 2%	
14	5010-09428-00	R45, R46, R47, R52, R54, R56	RESISTOR, 1.5K OHM 1/4 W 2%	
13	5010-10204-00	R23, R33, R37, R41	RESISTOR, 1K OHM 1/4 W 2%	
12	5010-09358-00	R18, R19, R21, R22, R24, R53, R55, R57	RESISTOR, 1K OHM 1/4 W	[illegible]
11	5010-09061-00	R73	RESISTOR, 680 OHM 1/2 W	
10	5010-09033-00	R14	RESISTOR, 680 OHM 1/4 W	1
9	5010-10457-00	R44, R48, R50	RESISTOR, 470 OHM 1/4 W 2%	[illegible]
8	5010-09001-00	R17	RESISTOR, 330 OHM 1/4 W	
7	5010-09508-00	R49, R51	RESISTOR, 270 OHM 1/4 W 2%	2
6	5010-09361-00	R76	RESISTOR, 220 OHM 1/2 W	1
5	5010-09768-00	R70, R71, R72	RESISTOR, 180 OHM 1/4 W	[illegible]
4	5010-09787-00	R74	RESISTOR, 150 OHM 1/2 W	1
3	5010-09036-00	R25, R29, R64, R67, R68, R69	RESISTOR, 100 OHM 1/4 W	6
2	5010-09548-00	R75	RESISTOR, 68 OHM 1/4 W 2%	1
1	5777-10363-00		BARE P.C. BOARD	1

D-9924 V.G.G. Assembly Sht. 1 of 2

NOTES: 1. 'B' INDICATES BYPASS CAPACITOR.

2. '*' INDICATES PIN CUT FOR KEYING.

3. '•' INDICATES PIN 1 OR EMITTER 'E'.

D-9924 V.G.G. Assembly Sht. 2 of 2

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	12034 12-12-83

3J1 — ROM BRD CONN.

3J2

3J9

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR. Chuck Bleich
DWN BY K. Fleming
CHECKED BY D.D. DATE 12/9/83
APPROVAL C.B. DATE 12/8/83

DO NOT SCALE WORK TO DIMENSIONS SHOWN

FIRST PROJECT NO 3016
FIRST USAGE D-9924

REMOVE BURRS – BREAK SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ±.005 FILLETS .020 MAX

MATERIAL

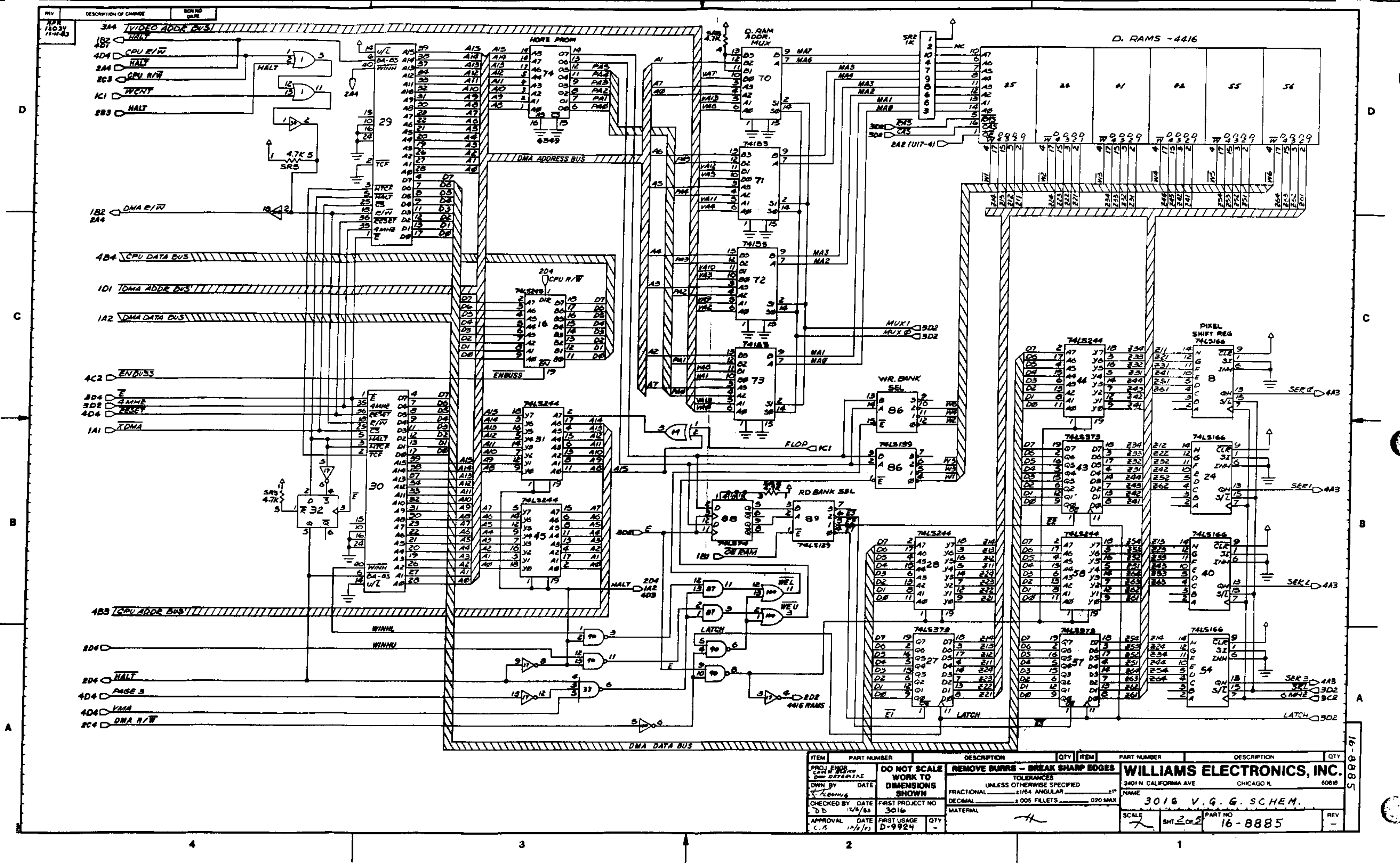
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618

NAME 3016 V.G.G. SCHEM.

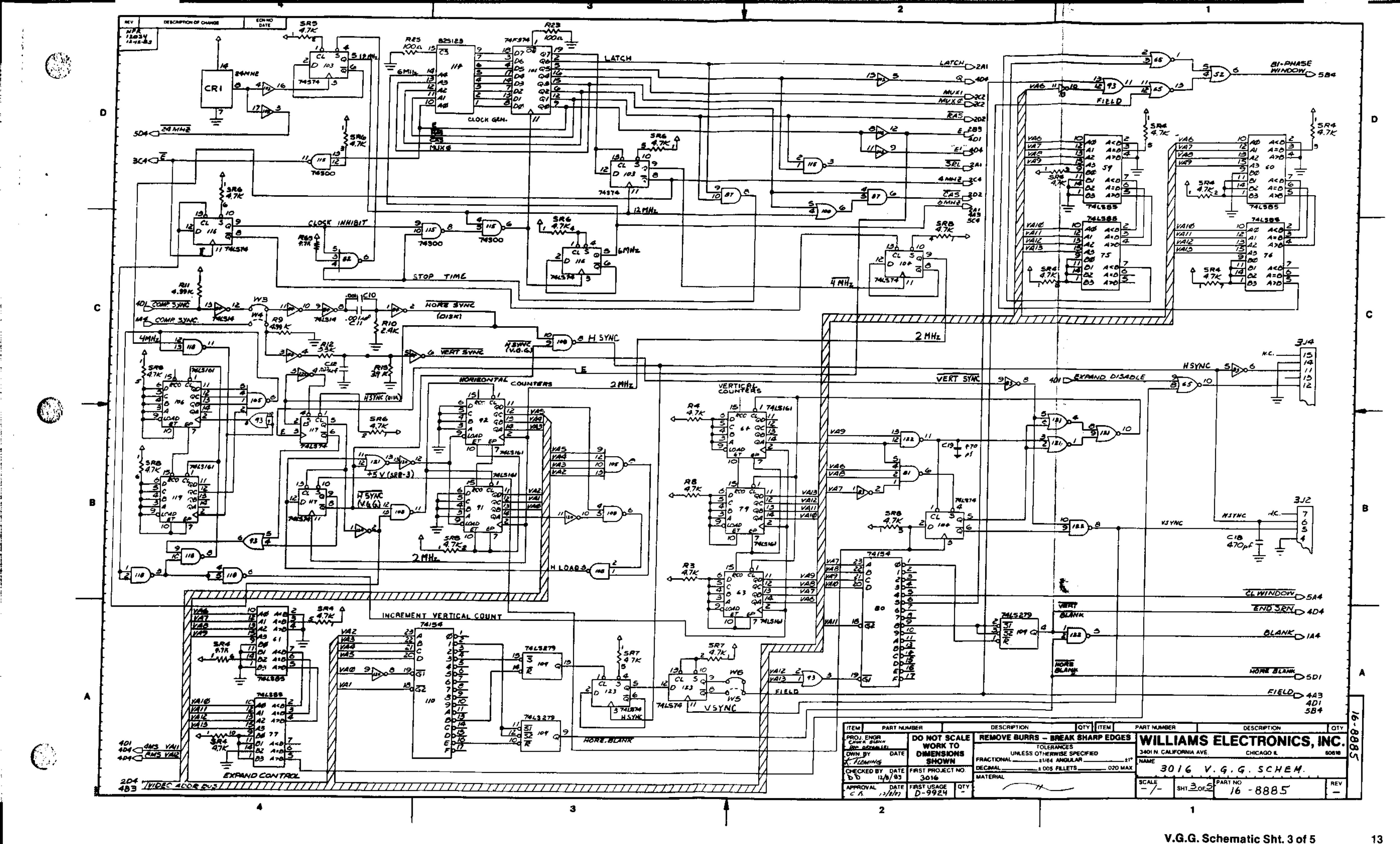
SCALE — SHT 1 OF 5 PART NO 16-8885 REV —

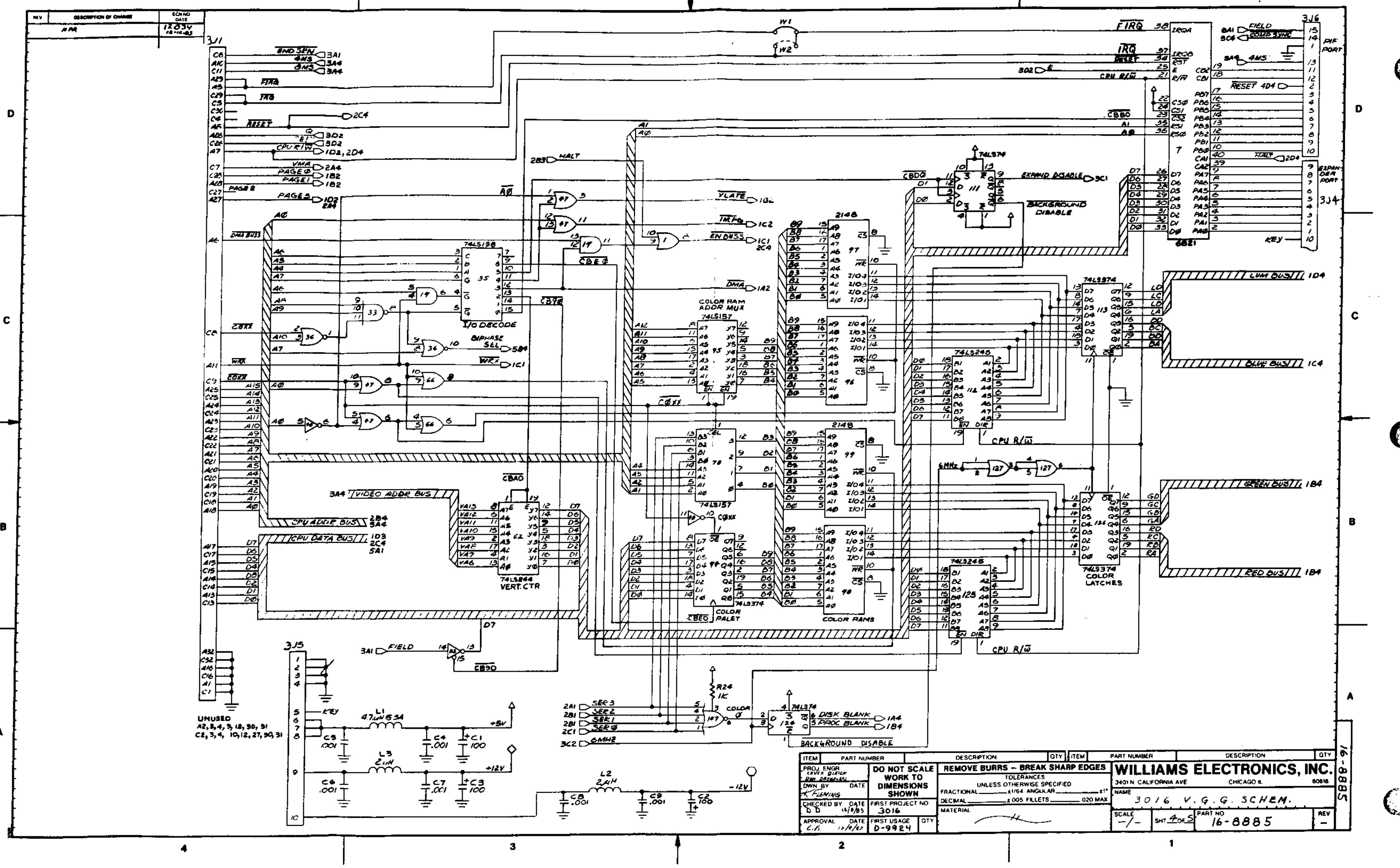
16-8885

V.G.G. Schematic Sht. 1 of 5

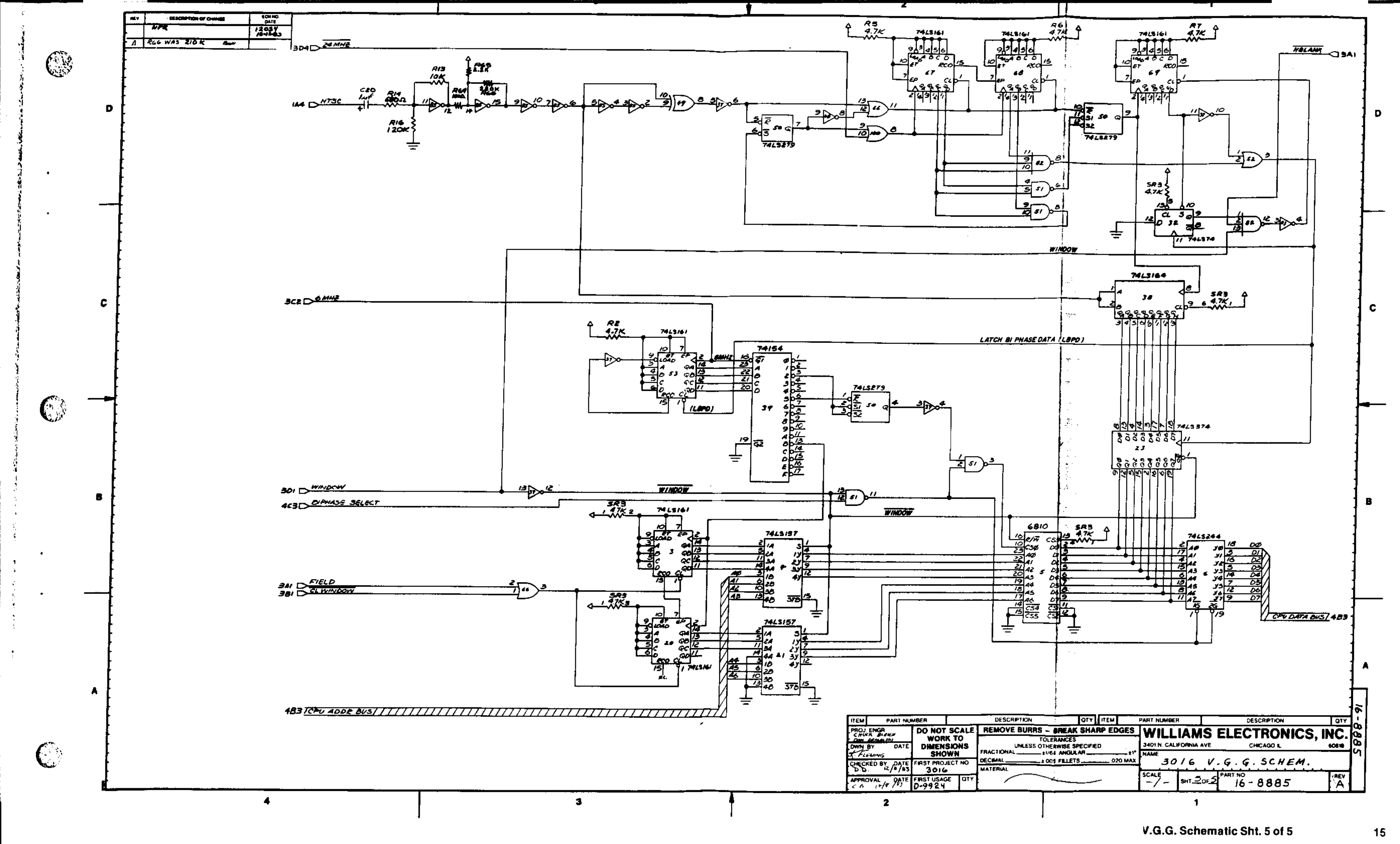


V.G.G. Schematic Sht. 2 of 5


WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL 60618
3016 V.G.G. SCHEM.
16-8885
SHT 3 OF 5
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES
FIRST PROJECT NO 3016
FIRST USAGE D-9924
CLOCK GEN.
HORIZONTAL COUNTERS
VERTICAL COUNTERS
INCREMENT VERTICAL COUNT
EXPAND CONTROL
VIDEO ADDR BUS
CLOCK INHIBIT
STOP TIME
LATCH
BI-PHASE WINDOW
FIELD
H SYNC
VERT SYNC
HORZ SYNC (DISK)
COMP SYNC
EXPAND DISABLE
CL WINDOW
END SRN
BLANK
HORZ BLANK
VSYNC



WILLIAMS ELECTRONICS, INC.
3401 N CALIFORNIA AVE CHICAGO IL 60618
3016 V.G.G. SCHEM.
SHT 4 OF 5
PART NO 16-8885
16-8885
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES
FIRST PROJECT NO 3016
FIRST USAGE D-9924
COLOR RAMS
COLOR LATCHES
COLOR RAM ADDR MUX
COLOR PALET
VERT. CTR
I/O DECODE
BIPHASE SEL
BACKGROUND DISABLE
EXPAND DISABLE
DISK BLANK
PROC BLANK
LUM BUS
BLUE BUS
GREEN BUS
RED BUS
VIDEO ADDR BUS
CPU ADDR BUS
CPU DATA BUS
DMA BUSS
CPU R/W
6821
74LS374
74LS245
74LS157
74LS138
74LS244
2148
UNUSED
A2,3,4,9,18,30,31
C2,3,4,10,12,27,30,31


WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618
3016 V.G.G. SCHEM.
16-8885
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS - BREAK SHARP EDGES
FIRST PROJECT NO 3016
FIRST USAGE D-9924
RGG WAS 210K
NTSC
24 MHZ
6 MHZ
WINDOW
BIPHASE SELECT
FIELD
CL WINDOW
HBLANK
LATCH BI PHASE DATA (LBPD)
CPU DATA BUS
CPU ADDR BUS
74LS161
74LS279
74LS374
74LS164
74154
74LS157
74LS244
6810

NOTES:

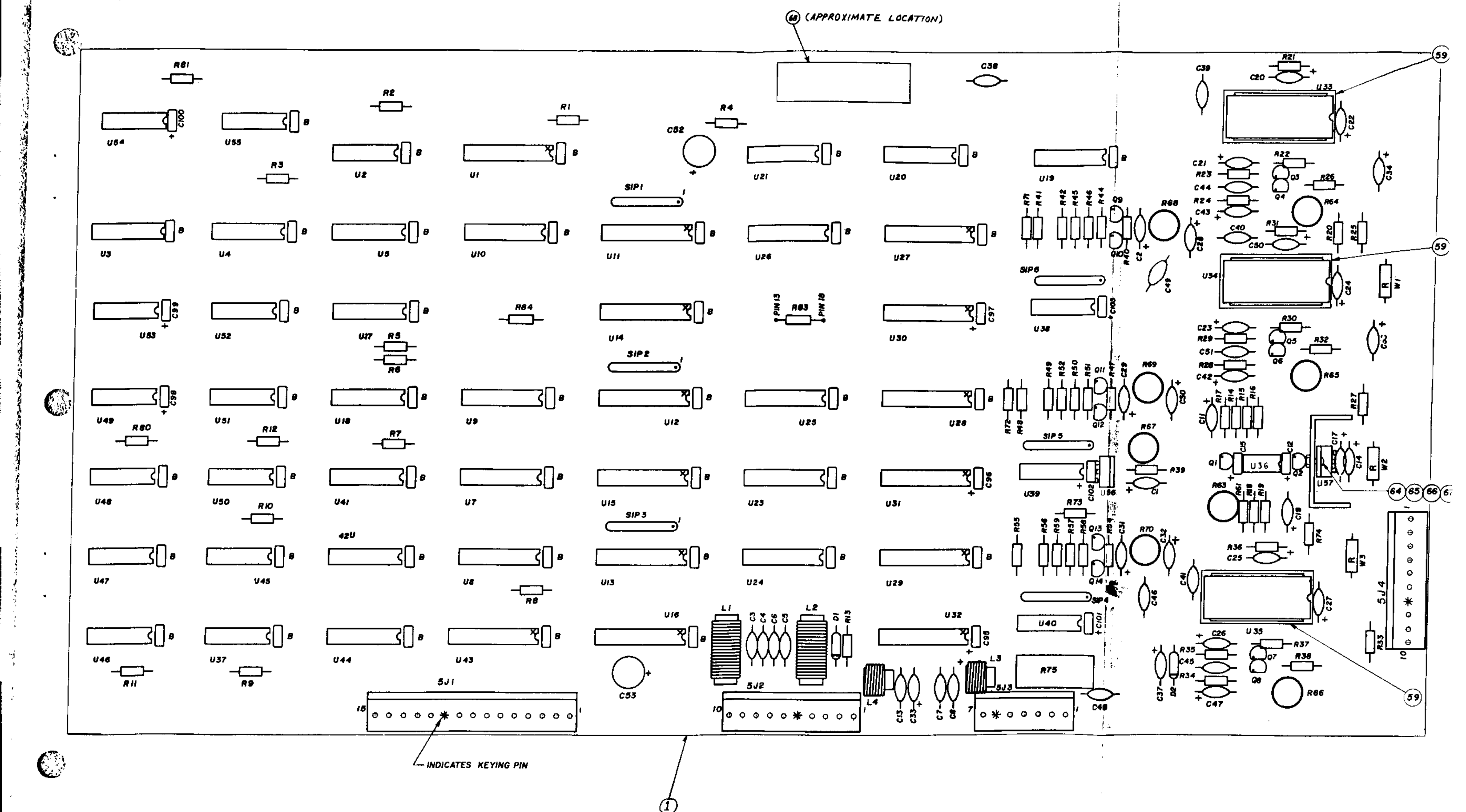
1. 1.KPF CAPS.
   C3, C4, C5, C6, C7, C13, C38, C39, C40, C41.
2. "B" BYPASS CAPS. .01MF ON IC'S NUMBER 1,2,3,4,5,7,8,9,10,11,12,13, 14,15,16,17,18,19,20,21,23,24,25,26, 27,28,29,37,42,43,44,45,46,47,48,50, 51,52,55
3. 10MF CAPS.
   C11,C17,C19,C20,C21,C22,C23,C24,C25, C26,C27,C37,C80.
4. 1MF CAPS.
   C2,C12,C14,C15,C29,C30,C31,C32,C34, C38,C42,C43,C47,C95,C96,C97,C98, C99,C100,C101,C102,C103,C1,C28,C35
5. TRANSISTORS 2N4126.
   Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8,Q12,Q14,Q10
6. RESISTORS 1.0K 1/4W 5%
   R17,R20,R23,R29,R35,R74,R83,R84
7. RESISTORS 4.7K 2%
   R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,R11, R12,R21,R31,R36,R44,R51,R58,R80,R81
8. IC 2148 S.RAMS
   U7, U8, U9, U10, U23, U24, U25, U26.
9. IC 74F374
   U11, U12, U13, U14, U15, U16, U27, U28, U29, U30, U31, U32.
10. IC 74F74
    U2, U37, U45, U46, U47, U50, U51, U54, U55

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
68	K-8850-92		LABEL- PCB ID	1
67	4703-0007-00		LW #6 EXTERNAL	1
66	4006-01003-06		MS 6-32 X 3/8 P-PH-S	1
65	4406 0117-00		NUT 6-32 HEX	1
64	20-9229		THERMAL COMPOUND	A.R.
63	5791-09074-00	J1	HEADER, 15H2391 09-65-1151	1
62	5791-09497-00	J3	HEADER, 7H2391 09-65-1071	1
61	5791-09444-00	J4, J2	HEADER, 10H2391 09-65-1101	2
60	5705-09199-00		H/SINK, 6030 B	1
59	5700-09004-00		SOCKET, IC 24 PIN	3
58	5043-09845-00	SEE NOTE 1	CAPACITOR, 1KPF 50V +/-20A	10
57	5043-09492-00	C44, C45, C51 C46, C48, C49	CAPACITOR, 100PF 50V +/-10	6
56	5043-08980-00	SEE NOTE 2	CAPACITOR, .01M 50V +80-20	40

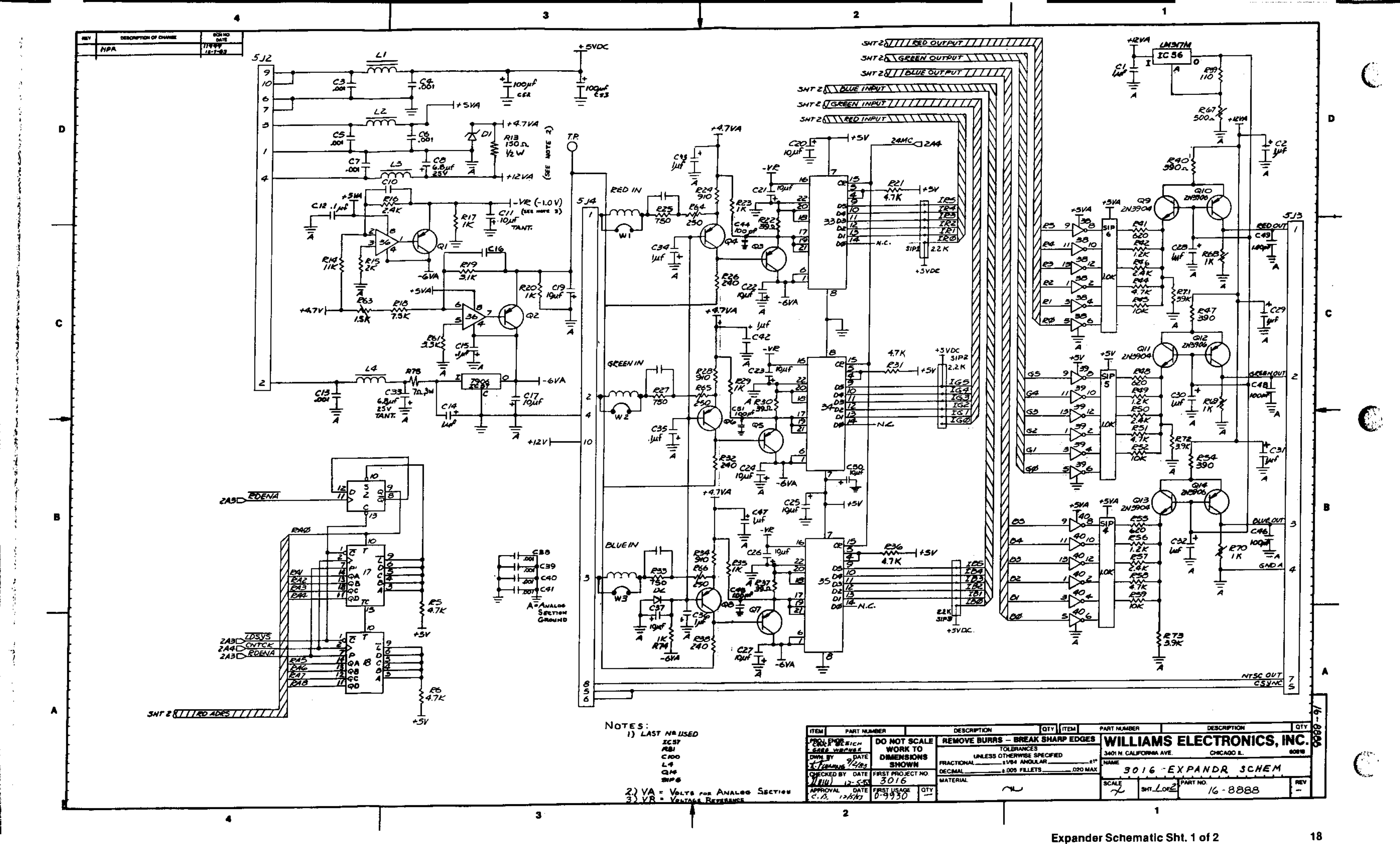
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY
55	5041-10588-00	C8, C33	CAPACITOR, 6.8M 25V 20%	2
54	5041 09243-00	SEE NOTE 3	CAPACITOR, 10M 10V +/-10	13
53	5041-09051-00	SEE NOTE 4	CAPACITOR, 1M 25V +/-20	25
52	5040-09421-00	C52, C53	CAPACITOR, 100M 25V +50-10	2
51	5075-10476-00	D1	DIODE, ZENER 1N5230B	1
50	5070-08919-00	D2	DIODE, SILICON 1N4148	1
49	5190-10590-00	SEE NOTE 5	TRANSISTOR, 2N4126	11
48	5160-10589-00	Q9, Q11, Q13	TRANSISTOR, 2N4124	3
47	5551-10161-00	L3, L4	COIL, 2µh 3A	2
46	5551-09822-00	L1, L2	COIL, 4.7µh 3A	2
45	5019-10601-00	SIP1, SIP2, SIP3	SIP, 2.2K OHMS 7R 8P 5%	3
44	5019-10600-00	SIP4, SIP5, SIP6	SIP, 1K OHMS 7R 8P 5%	3
43	5015-10587-00	R63	TRIM POT, 1.5K	1
42	5015-10420-00	R68, R69, R70	TRIM POT, 1K OHMS	3
41	5015-10419-00	R67	TRIM POT, 500 OHMS	1
40	5015-10418-00	R64, R65, R66	TRIM POT, 250 OHMS	3
39	5010-08998-00	R15	RESISTOR, 2.2K OHMS 1/4W 5%	1
38	—/—			—/—
37	5013-10547-00	R14	RESISTOR, 11K OHMS 1/4W 2%	1
36	5013-10546-00	R45, R52 R59	RESISTOR, 10K OHMS 1/4W 2%	3
35	5010-10022-00	R18	RESISTOR, 7.5K OHMS 1/4W	1
34	5013-10544-00	R19	RESISTOR, 5.1K OHMS 1/4W 2%	1
33	5013-10543-00	R71, R72, R73	RESISTOR, 3.9K OHMS 1/4W 2%	3
32	5013-10542-00	R16, R46, R50, R57	RESISTOR, 2.4K OHMS 1/4W 2%	4
31	5013-10541-00	R42, R49, R56	RESISTOR, 1.2K OHMS 1/4W 2%	3
30	5013-10540-00	R24, R28 R34	RESISTOR, 910 OHMS 1/4W 2%	3
29	5013-10539-00	R25, R27, R33	RESISTOR, 750 OHMS 1/4W 2%	3
28	5013-10538-00	R41, R48, R55	RESISTOR, 620 OHMS 1/4W 2%	3
27	5013-10537-00	R26, R32, R38	RESISTOR, 240 OHMS 1/4W 2%	3
26	5013-10536-00	R39	RESISTOR, 110 OHMS 1/4W 2%	1

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
25	5012-10586-00	R75	RESISTOR, 7 OHMS 3W	1
24	5010-10206-00	R40, R47, R54	RESISTOR, 390 OHMS 1/4W 2%	3
23	5010-10204-00	SEE NOTE 6	RESISTOR, 1.0K OHMS 1/4W 2%	8
22	5010-09634-00	W1, W2, W3	RESISTOR, 0 OHMS	3
21	—/—			—/—
20	5010-09212-00	R22, R30, R37	RESISTOR, 39 OHMS 1/4W 5%	3
19	5010-09187-00	R13	RESISTOR, 150 OHMS 1/4W 5%	1
18	5013-10497-00	SEE NOTE 7	RESISTOR, 4.7K OHMS 1/4W 2%	20
17	5010-08983-00	R61	RESISTOR, 3.3K OHM 1/4W 5%	1
16	5280-09489-00	U17, U18	IC, 9316 CNTR	2
15	5521-10421-00	U53	IC, OSC 48MHZ 1%	1
14	5250-10478-00	U56	REGULATOR, LM317K ADJ POS	1
13	5250-10477-00	U57	REGULATOR, 7906 1.0A 6V	1
12	5372-10467-00	U33, U34, U39	IC, TDC1014J ADC	3
11	5370-09321-00	U36	IC, 1458 OP-AMP	1
10	5340-10433-00	SEE NOTE 8	S/RAM, 1Kx4 35NS	8
9	5283-10551-00	U48, U52	IC, 74F00 NAND GATE	2
8	5282-10189-00	U49	IC, D 74S37 2IP	1
7	5283-10470-00 / 5282-10432-00	SEE NOTE 9	IC, 74F374 OCT LCH / IC, 74S374 OCT F/F	12
6	5282-10430-00 / 5283-10554-00	U41, U42 U44	IC, 74S161 CNTR / IC, 74F161 SYNC CTR	3
5	5283-10469-00 / 5282-10431-00	U3, U4, U5 U19, U20, U21	IC, 74F257 2TO1 MUX / IC, 74S257A MLTPX	6
4	5283-10468-00 / 5282-10190-00	SEE NOTE 10	IC, 74F74 DUAL F/F / IC, 74S74 DUAL F/F	9
3	5283-10552-00 / 5282-10186-00	U38, U39 U40	IC, 74F04 INVERTER / IC 74S04 HEX INV	3
2	5281-09736-00	U1, U43	IC, 74LS273 OCT F/F	2
1	5779-10366-00	—	BARE P.C. BOARD	1

B I L L O F M A T E R I A L S



D-9930 Expander Assembly Sht. 2 of 2



Expander Schematic Sht. 1 of 2

ITEM	PART NUMBER	DESCRIPTION	QTY

DO NOT SCALE WORK TO DIMENSIONS SHOWN

REMOVE BURRS – BREAK SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED

FRACTIONAL ±1/64 ANGULAR ±1°

DECIMAL ±.005 FILLETS .020 MAX

MATERIAL

PROJ. ENGR. CHUCK BLAICO, GREG WAPPES

DWN. BY K. FLEMING 9/1/83

CHECKED BY 12-5-83

APPROVAL C.B. 12/5/83

FIRST PROJECT NO. 3016

FIRST USAGE D-9930

WILLIAMS ELECTRONICS, INC.

3401 N. CALIFORNIA AVE. CHICAGO IL. 60618

NAME 3016 EXPANDR SCHEM

SCALE —

SHT 2 OF 2

PART NO. 16-8888

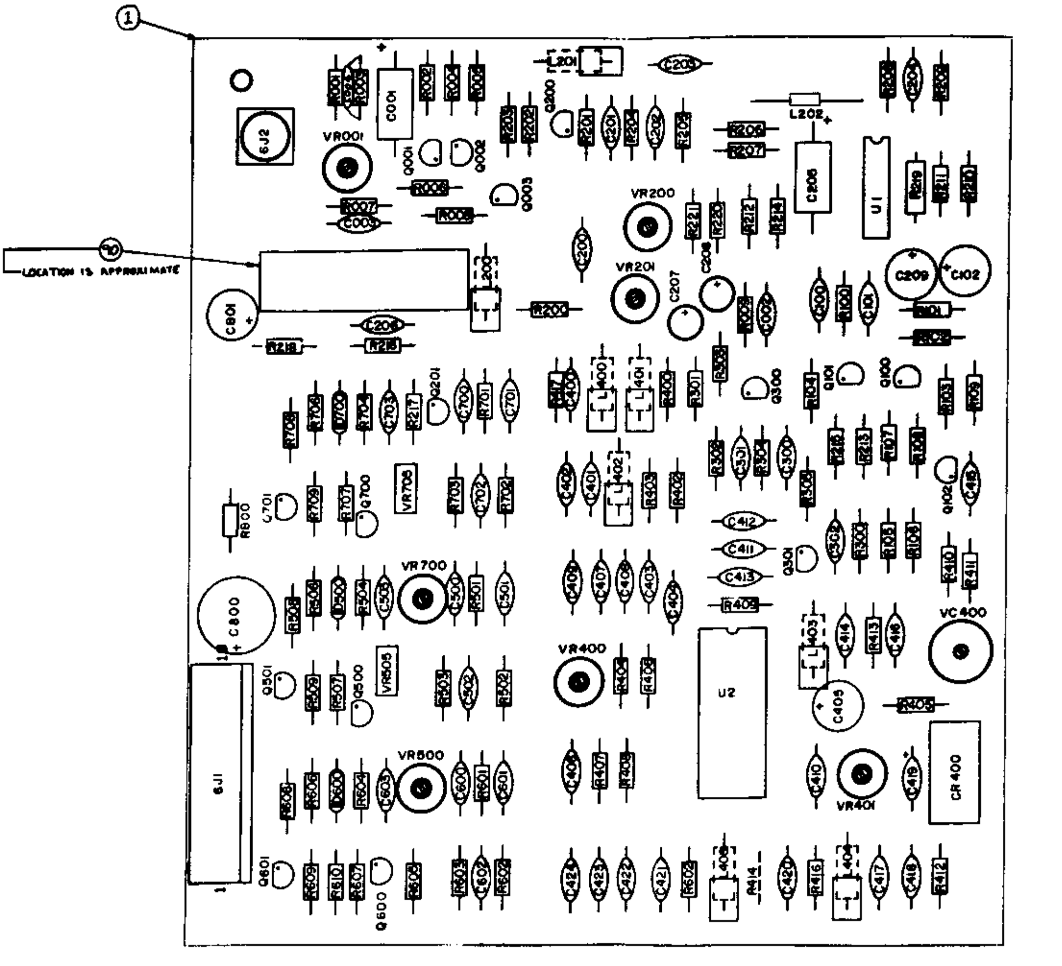
REV —

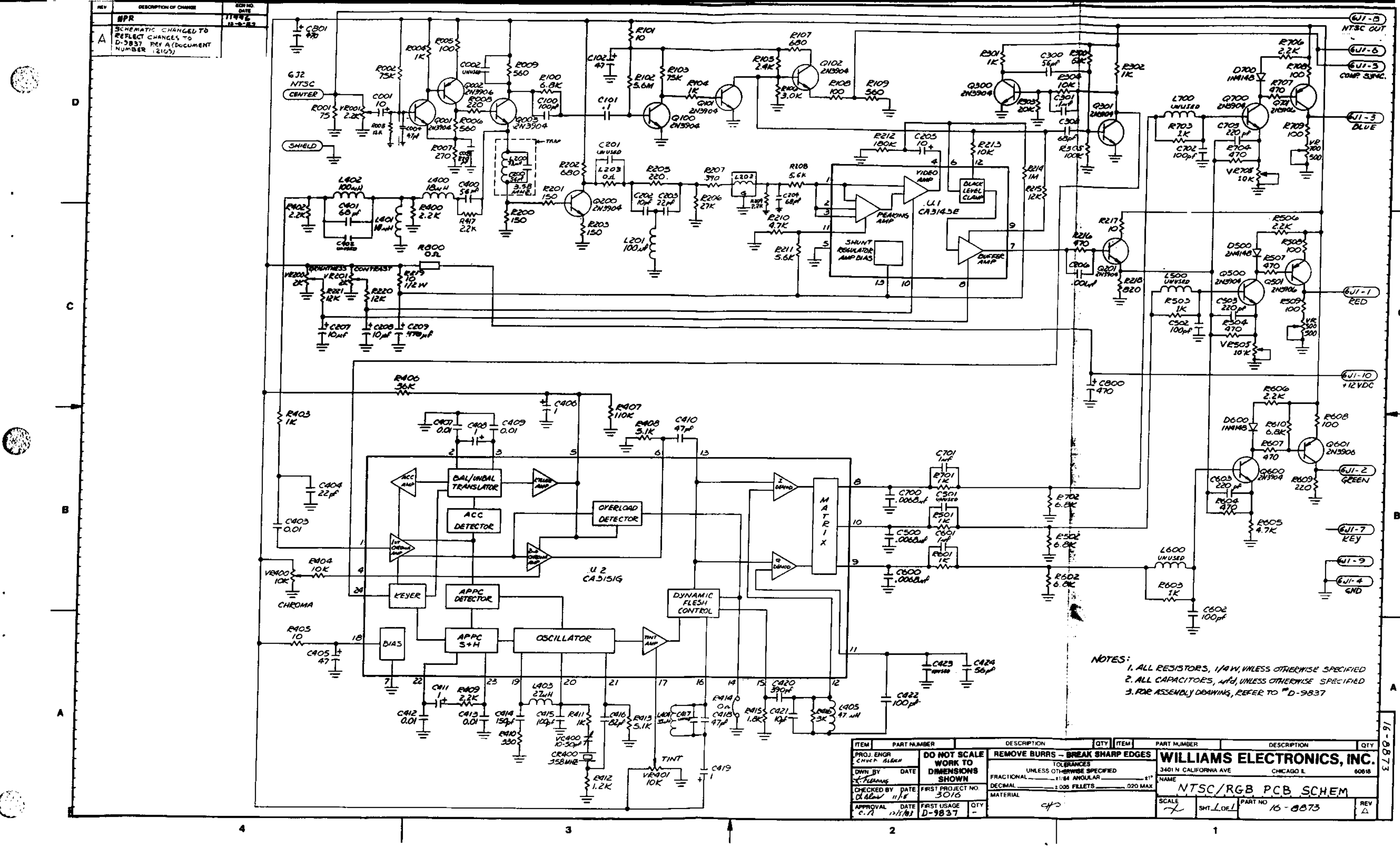
16-8888

NOTES:

1. TRANSISTORS, 2N3904;
   Q001, Q003, Q100, Q101, Q102, Q200, Q201, Q300, Q301, Q500, Q600, Q700.
2. RESISTORS, 1K OHM 1/4W
   R004, R104, R301, R302, R409, R411, R501, R503, R601, R603, R701, R703.
3. ITEM 79 (TRAP 3.58 MHZ) IS AN APPROVED SUBSTITUTE FOR ITEM 45 (C200) AND ITEM 74 (L200).
4. ITEM 83 - IC ECG 1177 LUM. PROC. WILLIAMS PART NO. 5370-10664-00 IS AN APPROVED SUBSTITUTE FOR ITEM 83.

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.	ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.	ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
90	16-8850-93		LABEL - PCB ID	1	60	-/-			-/-	30	5010-10650-00	R300	RESISTOR, 62K OHM 1/4W	1
89	5320-09020-00	CR400	XTAL/OSC. 3.58 MHZ XTAL.	1	59	5040-09422-00	C102, C405	CAPACITOR, 47 UF 25V	2	29	5010-09342-00	R406	RESISTOR, 36K OHM 1/4W	1
88					58	5041-09343-00	C001, C205	CAPACITOR, 10 UF 25V LOW LEAK	2	28	5010-09324-00	R206	RESISTOR, 27K OHM 1/4W	1
87	5791-09444-00	J1	CONNECTOR 10P MALE MOLEX	1	57	5040-09031-00	C406, C411 C419, C408	CAPACITOR, 1 UF 25V TANT	4	27	5013-10548-00	R303	RESISTOR, 20K OHM 1/4W	1
86	5797-10274-00	J2	CONNECTOR, BNC P.C. MOUNT STYLE	1	56	5045-10642-00	C601, C701	CAPACITOR, 1 UF 50V	2	26	5010-09269-00	R003, R215 R221, R220	RESISTOR, 12K OHM 1/4W	4
85	-/-			-/-	55	5043-08996-00	C101, C301	CAPACITOR, .1 UF	2	25	5010-09034-00	R213, R304, R404	RESISTOR, 10 KOHM 1/4W	3
84	5370-10273-00	U2	I.C. CA3151G	1	54	5043-08980-00	C403, C407, C409 C412, C413	CAPACITOR, .01 UF	5	24	5010-09086-00	R100, R502, R602 R702, R610	RESISTOR, 6.8K OHM 1/4W	5
83	5370-10272-00	U1	I.C. CA3143E (SEE NOTE 4)	1	53	5043-10641-00	C500, C600 C700	CAPACITOR, .0068 UF 50V	3	23	5010-08991-00	R605, R210	RESISTOR, 4.7K OHM 1/4W	2
82	-/-			-/-	52	5043-09845-00	C206	CAPACITOR, .001 UF	1	22	5013-09665-00	R408, R413	RESISTOR, 5.11K OHM 1/4W	2
81	-/-			-/-	51	5043-10263-00	C420	CAPACITOR, 390 PF	1	21	5010-10002-00	R106, R416	RESISTOR, 5 KOHM 1/4W	2
80	-/-			-/-	50	5043-10644-00	C503, C603 C703, C003	CAPACITOR, 220 PF 50V	4	20	5010-10236-00	R105	RESISTOR, 2.4K OHM 1/4W	1
79	5551-10279-00	(SEE NOTE 3)	TRAP 3.58 MHZ	0	49	5043-10267-00	C414	CAPACITOR, 130 PF	1	19	5010-08998-00	R209, R400, R402, R403, R417, R506, R606, R706	RESISTOR, 2.2K OHM 1/4W	8
78	-/-			-/-	48	5043-09492-00	C415, C422, C502 C602, C702, C100	CAPACITOR, 100 PF	6	18	5010-09117-00	R415	RESISTOR, 1.8K OHM 1/4W	1
77	-/-			-/-	47	5043-10266-00	C416	CAPACITOR, 82 PF	1	17	5010-09314	R412	RESISTOR, 1.2K OHM 1/4W	1
76	5551-10648-00	L201, L402, L203, L202	COIL, 100 UH	4	46	5043-10264-00	C302, C401, C204	CAPACITOR, 68 PF	3	16	5010-09358-00	SEE NOTE #2	RESISTOR, 1K OHM 1/4W	12
75	5551-10277-00	L405	COIL, 47 UH	1	45	5043-10643-00	C200, C300, C400, & C424 (SEE NOTE 3)	CAPACITOR, 56 PF 50V	4	15	5010-09356-00	R218	RESISTOR, 820 OHM 1/4W	1
74	5551-10647-00	L404, L200 (SEE NOTE 3)	COIL, 33 UH	2	44	5043-09844-00	C410 C418, C004	CAPACITOR, 47 PF	3	14	5010-09033-00	R107, R202	RESISTOR, 680 OHM 1/4W	2
73	5551-10276-00	L403	COIL, 27 UH	1	43	5043-09491-00	C203 C404	CAPACITOR, 22 PF	2	13	5010-08992-00	R006, R009, R109	RESISTOR, 560 OHM 1/4W	3
72					42	5043-10640-00	C202, C421	CAPACITOR, 10 PF 50V	2	12	5010-09416-00	R216, R504, R604 R704, R507, R607 R707	RESISTOR, 470 OHM 1/4W	7
71	5551-10645-00	L400, L401	COIL, 18 UH	2	41	5010-09363-00	R208, R211	RESISTOR, 5.6K OHM 1/4W 50 MW 80%	2	11	5010-10003-00	R207	RESISTOR, 390 OHM 1/4W	1
70	-/-			-/-	40	5015-10659-00	VR501, VR701	POT., 10K OHM UPRIGHT	2	10	5010-09001-00	R410	RESISTOR, 330 OHM 1/4W	1
69	5070-08919-00	D500, D600 D700	DIODE, IN4148	3	39	5014-10261-00	VR400, VR401	POT., 10K OHM	2	9	5010-09224-00	R007	RESISTOR, 270 OHM 1/4W	1
68	5070-06258-00	D800	DIODE, IN4001	1	38	5014-10260-00	VR001, VR200 VR201	POT., 2K OHM	3	8	5010-09160-00	R008, R609	RESISTOR, 220 OHM 1/4W	2
67	-/-			-/-	37	5015-10419-00	VR500, VR700	POT., 500 OHM	2	7	5010-09187-00	R200, R201, R203	RESISTOR, 150 OHM 1/4W	3
66	5190-10270-00	Q002, Q501 Q601, Q701	TRANSISTORS, 2N3906 PNP	4	36	5010-10259-00	R102	RESISTOR, 3.6M OHM 1/4W	1	6	5010-09036-00	R005, R108, R508, R604, R608, R708, R705, R205	RESISTOR, 100 OHM 1/4W	8
65	5160-10269-00	SEE NOTE #1	TRANSISTOR, 2N3904 NPN	12	35	5010-10258-00	R214	RESISTOR, 1M OHM 1/4W	1	5	5010-10254-00	R001	RESISTOR, 75 OHM 1/4W	1
64	5040-09777-00	C207, C208	CAPACITOR, 10 UF RAD	2	34	5010-09333-00	R212	RESISTOR, 180K OHM 1/4W	1	4	5010-09039-00	R101, R217, R405	RESISTOR, 10 OHM 1/4W	3
63	-/-			-/-	33	5010-10271-00	R407	RESISTOR, 110K OHM 1/4W	1	3	5010-10255-00	R219	RESISTOR, 10 OHM 1/2W	1
62	5049-10268-00	VC400	TRIMMER, 10-60 PF	1	32	5010-09162-00	R305	RESISTOR, 100K OHM 1/4W	1	2	5010-09334-00	R414, R204	RESISTOR, 0 OHM 1/4W	2
61	5040-09776-00	C209, C800, C801	CAPACITOR, 470 UF 16V	3	31	5010-10257-00	R002, R103	RESISTOR, 75K OHM 1/4W	2	1	5779-10275-00		BARE P.C. BOARD	1

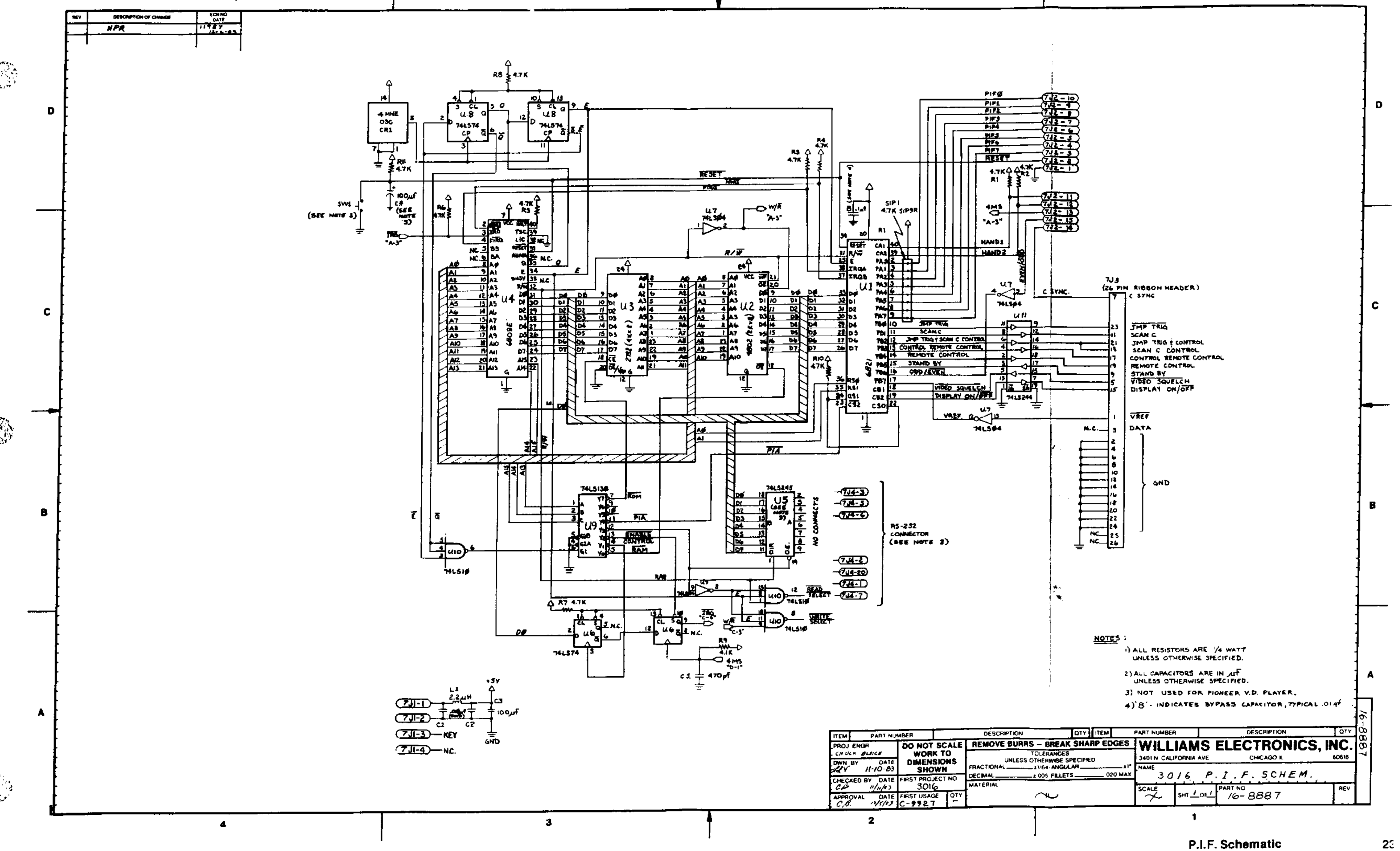



A
SCHEMATIC CHANGED TO REFLECT CHANGES TO D-9837 REV A (DOCUMENT NUMBER 12103)
11996
NOTES:
1. ALL RESISTORS, 1/4 W, UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS, ufd, UNLESS OTHERWISE SPECIFIED
3. FOR ASSEMBLY DRAWING, REFER TO #D-9837
WILLIAMS ELECTRONICS, INC.
3401 N CALIFORNIA AVE
CHICAGO IL
60618
NTSC/RGB PCB SCHEM
16-8873
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES
FIRST PROJECT NO. 3016
FIRST USAGE D-9837
U1 CA3143E
U2 CA3151G
VIDEO AMP
PEAKING AMP
BLACK LEVEL CLAMP
BUFFER AMP
SHUNT REGULATOR AMP BIAS
BAL/UNBAL TRANSLATOR
ACC DETECTOR
OVERLOAD DETECTOR
APPC DETECTOR
APPC S+H
OSCILLATOR
KEYER
BIAS
DYNAMIC FLESH CONTROL
MATRIX
NTSC CENTER
SHIELD
BRIGHTNESS
CONTRAST
CHROMA
TINT
6J1-8 NTSC OUT
6J1-6
6J1-5 COMP. SYNC.
6J1-3 BLUE
6J1-1 RED
6J1-10 +12VDC
6J1-2 GREEN
6J1-7 KEY
6J1-9
6J1-4 GND

GAME NAME	STAR RIDER
ASSY NO.	C-9928
U3	A-5343-10636

NOTES:
1) 'B' - INDICATES BYPASS CAPACITORS.
2) FOR SCHEMATIC REFER TO DWG. 16-8887.

ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
33	5700-09004-00	IC3	SOCKET, 24 PIN	1
32	-//-			-//-
31	-//-			-//-
30	-//-			-//-
29	5551-10161-00	L1	COIL, 2.2 UH	1
28	5521-10506-00	CR1	XTAL / OSC., 4MHZ OSC.	1
27	-//-			-//-
26	-//-			-//-
25	5791-10604-00	J3	CONNECTOR, 26PIN RIB. HEADER/SHROUD	1
24	5791-09074-00	J2	CONNECTOR, 15P MALE MOLEX	1
23	5791-09028-00	J1	CONNECTOR, 4P MALE MOLEX	1
22	-//-			-//-
21	5281-09215-00	U7	I.C. 74LS04	1
20	5281-09867-00	U11	I.C. 74LS244	1
19	5281-09235-00	U10	I.C. 74LS10	1
18	5281-09487-00	U6, U8	I.C. 74LS74	2
17	5340-09878-00	U2	I.C. 2KX8 RAM	1
16	-//-			-//-
15	-//-			-//-
14	5281-09745-00	U9	I.C. 74LS138	1
13	5430-08972-00	U1	I.C. 6821 PIA	1
12	5400-09490-00	U4	I.C. 6809E MPU	1
11	-//-			-//-
10	-//-			-//-
9	5043-09845-00	C1, C2	CAPACITOR, .001 UF	2
8	5043-08980-00	B (SEE NOTE 1)	CAPACITORS, .01 UF	10
7	5040-09421-00	C3	CAPACITOR, 100 UF 25V	1
6	5043-09065-00	C5	CAPACITOR, 470 PF	1
5	-//-			-//-
4	5010-08991-00	R1 THRU R11	RESISTORS, 4.7K OHM 1/4 W	11
3	5019-09362-00	SIP1	RESISTOR, 4.7K OHM SIP 9R	1
2	-//-			-//-
1	5772-10365-00		BARE P.C. BOARD	1

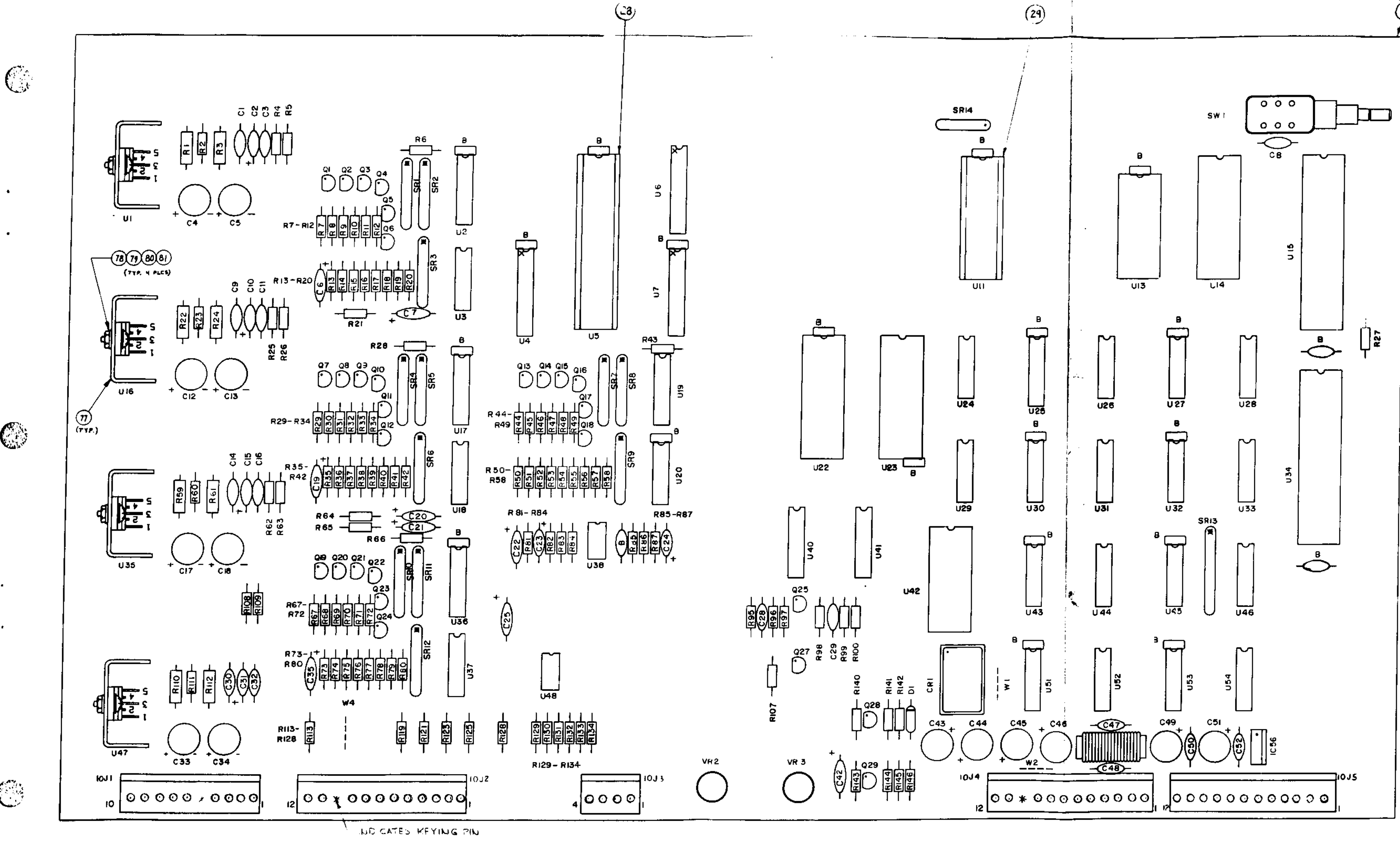


P.I.F. Schematic

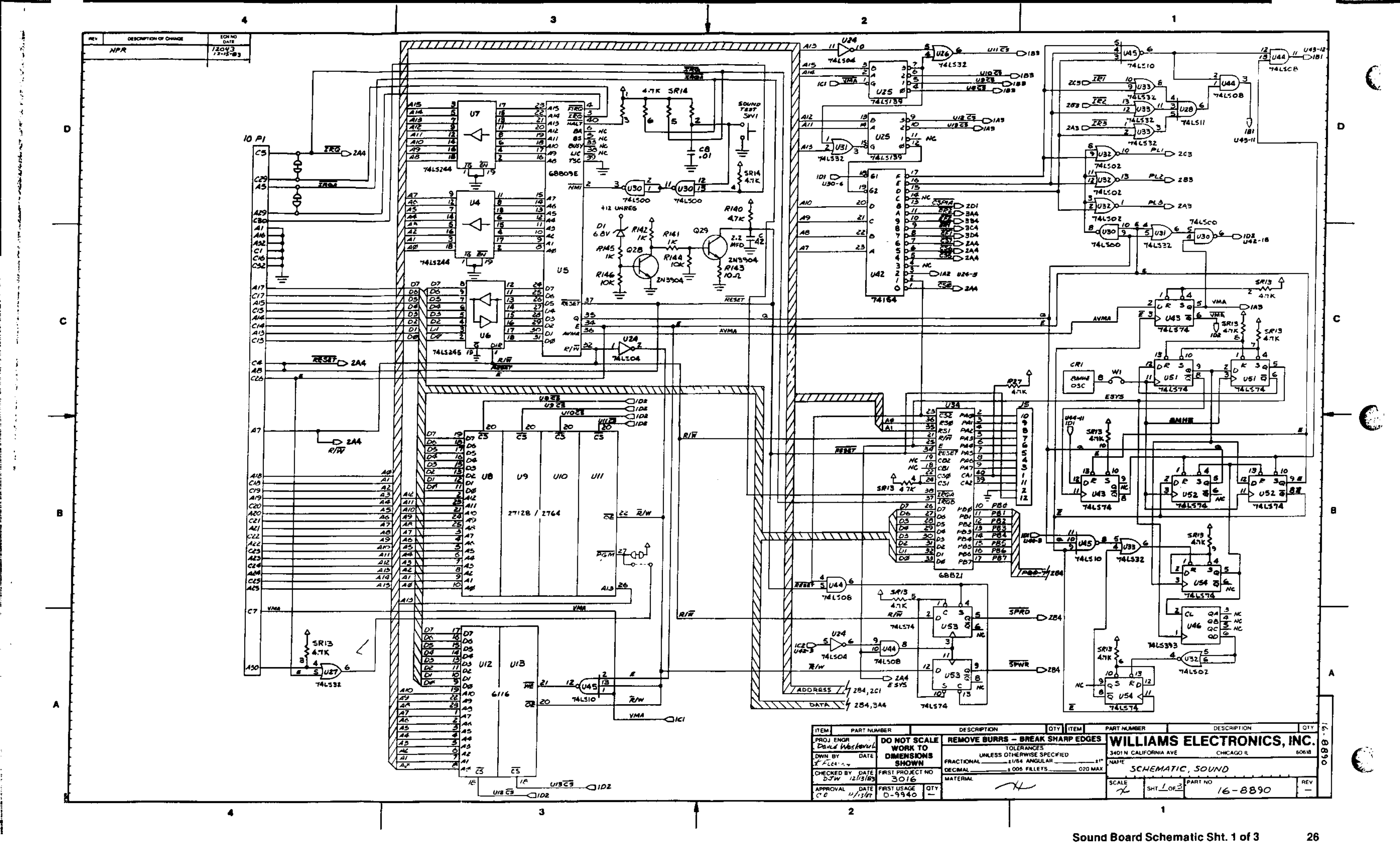
NOTES:
1.-FOR SCHEMATIC REFER TO DWG.# 16-8890
2.-RESISTOR, 4.7KΩ:
R6, R21, R27, R28, R43, R50, R64, R65, R66, R113, R119, R121, R123, R125, R128, R140
3.-RESISTOR, 1KΩ:
R4, R5, R25, R26, R62, R63, R108, R109, R141, R142, R145
4.-CAPACITOR, 10 MFD.:
C2, C6, C7, C10, C15, C19, C20, C21, C22, C23, C24, C25, C31, C35

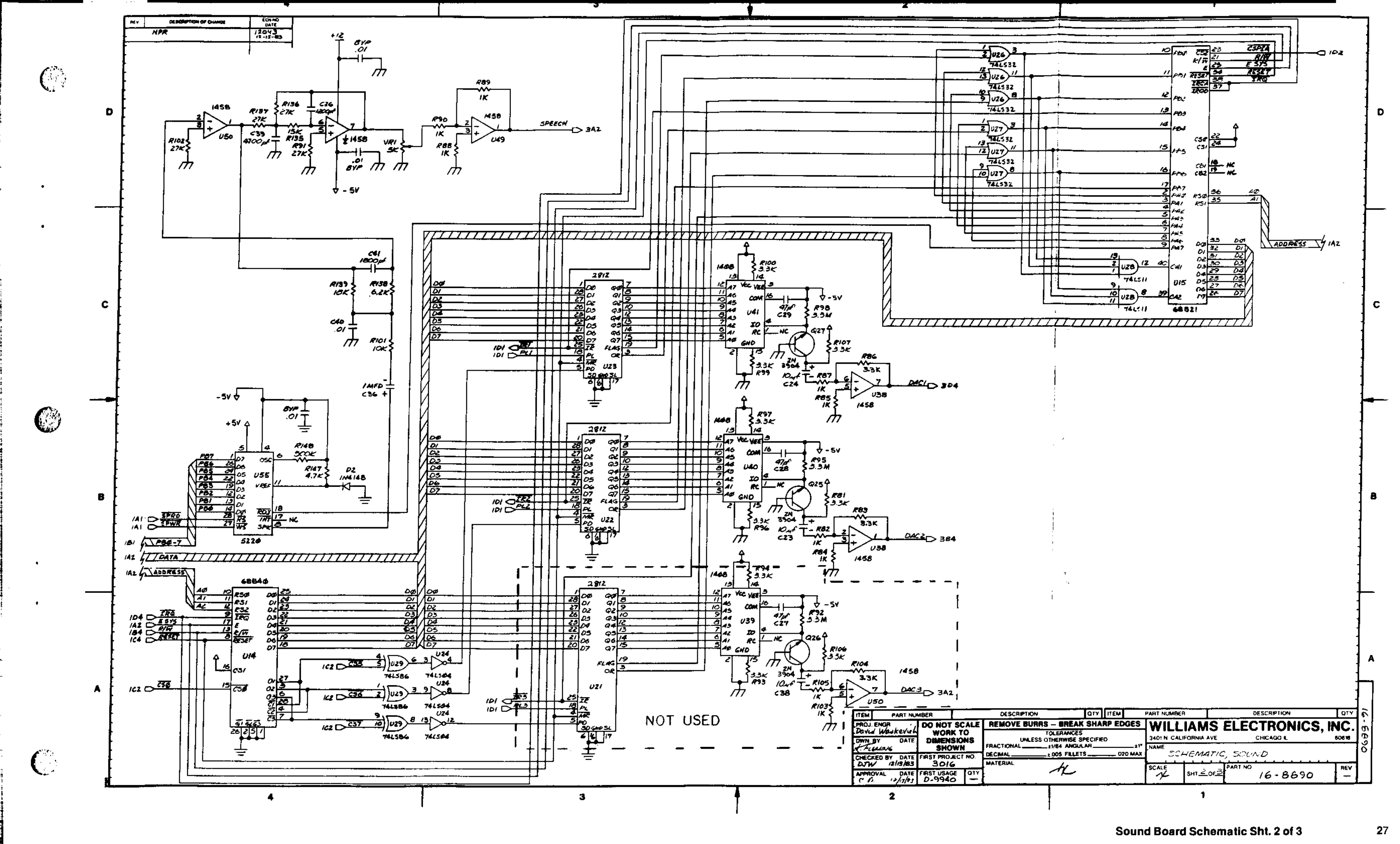
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.	ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.	ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY
					60	5014-10261-00	VR2, VR3	TRIM POT, PC MOUNT 10K OHM	2	30	A 5343 10663	U11	SOUND ROM (ROM 27) 2764	#
					59	#			#	29	5700-10176-00		SOCKET, 28-PIN IC	1
					58	5010-09181-00	R3, R24, R61, R112	RESISTOR, 1 OHM 1/2W 5%	4	28	5700-08985-00		SOCKET, 40-PIN IC	1
					57	5010-09361-00	R1, R22, R59, R110	RESISTOR, 220 OHM 1/2W 5%	4	27	5400-10320-00	U5	MPU, 68B09E	#
82	5344-10440-00		IC, 2812 FIFO	2	56	5010-10437-00	R11, R14, R33, R36, R48, R52, R71, R74	RESISTOR, 470 OHM 1/4W 2%	8	26	5250-09515-00	U56	IC, 7905 REG. -5V 1A	1
	5344-10429-00		IC, 2812 FIFO 2 MHZ	0	55	5010-10204-00	R9, R16, R31, R38, R46, R54, R69, R76	RESISTOR, 1.0K OHM 1/4W 2%	8	25	5370-09156-00	U11, U16, U35, U47	IC, TDA2002 AUD AMP	4
#				#	54	5010-10203-00	R12, R19, R34, R41, R49, R57, R72, R79	RESISTOR, 2.2K OHM 1/4W 2%	8	24	5370-09321-00	U38, U48	IC, 1458 OP-AMP, DUAL	2
81	20-9229		THERMAL COMPOUND	A/R	53	5013-10497-00	R10, R20, R32, R42, R47, R58, R70, R80	RESISTOR, 4.7K OHM 1/4W 2%	8	23	5371-09152-00	U40, U41	IC, 1408 D/A CONV	2
80	4703-00007-00		LOCK WASHER, #6 EXT. TOOTH	4	52	5013-10546-00	R17, R18, R39, R40, R55, R56, R77, R78	RESISTOR, 10K OHM 1/4W 2%	8	22	5340-09878-00	U13	IC, 2016 RAM/S 2KX8	1
79	4406-01117-00		HEX NUT 6-32	4	51	5013-10548-00	R8, R15, R30, R37, R45, R53, R68, R75	RESISTOR, 20K OHM 1/4W 2%	8	21	#			#
78	4006-01003-06		SCREW 6-32 X 3/8" P-PH-S	4	50	5010-09161-00	R2, R23, R60, R111	RESISTOR, 2.2 OHM 1/4W 5%	4	20	5433-10439-00	U14	IC, 68B40 PROG TIMER 2MHZ	1
77	5705-09199-00		HEAT SINK THERMALLOY #6030	4	49	5010-09534-00	W1, W2, W4	RESISTOR, 0 OHM 1/4W WIRE JUMPER	3	19	5430-10322-00	U15, U34	IC, 68B21 PIA 2MHZ	2
76	5791-09028-00	J3	4-PIN HEADER 09-65-1041	1	48	5010-09039-00	R143	RESISTOR, 10 OHM 1/4W 5%	1	18	#			#
75	5791-09444-00	J1	10-PIN HEADER 09-65-1101	1	47	5010-09358-00	SEE NOTE 3	RESISTOR, 1K 1/4W 5%	11	17	5281-09833-00	U46	IC, 74LS393 4-BIT COUNTER	1
74	5791-09043-00	J2, J4, J5	12-PIN HEADER 09-65-1121	3	46	5010-08983-00	R81, R83, R86, R96, R97, R99, R100, R107	RESISTOR, 3.3K 1/4W 5%	8	16	5281-09308-00	U6	IC, 74LS245 OCT TRNCV	1
73	5641-09312-00	SW1	SW P DPDT 100V 5A	1	45	5010-08991-00	SEE NOTE 2	RESISTOR, 4.7K 1/4W 5%	16	15	5281-09867-00	U4, U7	IC, 74LS244 OCTAL BUFFER	2
	5641-09371-00		SW P SPDT 115V 25A	0	44	5010-09034-00	R144, R146	RESISTOR, 10K 1/4W 5%	2	14	5281-09733-00	U2, U17, U19, U36	IC, 74LS174 HEX F/F	4
72	#			#	43	5010-09325-00	R7, R13, R29, R35, R44, R51, R67, R73	RESISTOR, 39K 1/4W 5%	8	13	5280-09010-00	U42	IC, 74154 4-16 DECODER	1
71	5043-09844-00	C28, C29	CAPACITOR, 47 PF 50V ±20%	2	42	5010-09162-00	R130, R131, R133, R134	RESISTOR, 100K 1/4W 5%	4	12	5281-09246-00	U25	IC, 74LS139 2-4 DECODER	1
70	5043-09845-00	C3, C11, C16, C32	CAPACITOR, .001 MFD 50V ±20%	4	41	5010-09442-00	R129, R132	RESISTOR, 330K 1/4W 5%	2	11	5281-09737-00	U29	IC, 74LS86 QUAD XOR	1
69	5043-08980-00	C8, C47, C48 BYPASS (B)	CAPACITOR, .01 MFD 50V +80-20	25	40	5010-09179-00	R95, R98	RESISTOR, 3.3M 1/4W 5%	2	10	5281-09487-00	U43, U51-U54	IC, 74LS74 DUAL D F/F	5
68	5043-08996-00	C1, C9, C14, C30, C50, C52	CAPACITOR, .1 MFD 50V ±20%	6	39	#			#	9	5281-09500-00	U26, U27, U31, U33	IC, 74LS32 QUAD OR	4
67	5041-09163-00	C42	CAPACITOR, 2.2 MFD	1	38	5019-09780-00	SR1 - SR12	SIP, 1K 4R8 5%	12	8	5281-09850-00	U28	IC, 74LS11 TRIPLE AND	1
66	5040-09343-00	SEE NOTE 4	CAPACITOR, ELECT, AXIAL 10 MFD 25V ±20% LL	0	37	5019-09786-00	SR14	SIP, 4.7K SR6 5%	1	7	5281-09235-00	U45	IC, 74LS10 TRIPLE NAND	1
	5041-09243-00		CAPACITOR, TANT, AXIAL 10 MFD 10V	14	36	5019-09362-00	SR13	SIP, 4.7K 9R10 5%	1	6	5281-09743-00	U44	IC, 74LS08 QUAD AND	1
65	5040-09422-00	C51	CAPACITOR, ELECT, RAD 47 MFD 50V +50-10%	1	35	#			#	5	5280-09309-00	U3, U18, U20, U37	IC, 7407 HEX BUF OC	4
64	5040-09421-00	C4, C12, C17, C33, C43, C44, C45, C46, C49	CAPACITOR, ELECT, RAD 100 MFD 25V, +50-10%	9	34	5520-10438-00	CR1	OSCILLATOR, 8 MHZ	1	4	5281-09215-00	U24	IC, 74LS04 HEX INVERTER	1
63	5040-09776-00	C5, C13, C18, C34	CAPACITOR, ELECT, RAD 470 MFD 16V +50-10%	4	33	5075-09018-00	D1	ZENER DIODE, 1N5996A 6.8V	1	3	5281-09247-00	U32	IC, 74LS02 QUAD NOR	1
62	#			#	32	5160-10269-00	Q25, Q27, Q28, Q29	TRANSISTOR, NPN 2N3904	4	2	5281-09499-00	U30	IC, 74LS00 QUAD NAND	1
61	5551-09822-00	L1	INDUCTOR, 4.7MH 3A	1	31	5190-10270-00	Q1 - Q24	TRANSISTOR, PNP 2N3906	24	1	5778-10369-00		BARE P.C. BOARD, SOUND	1

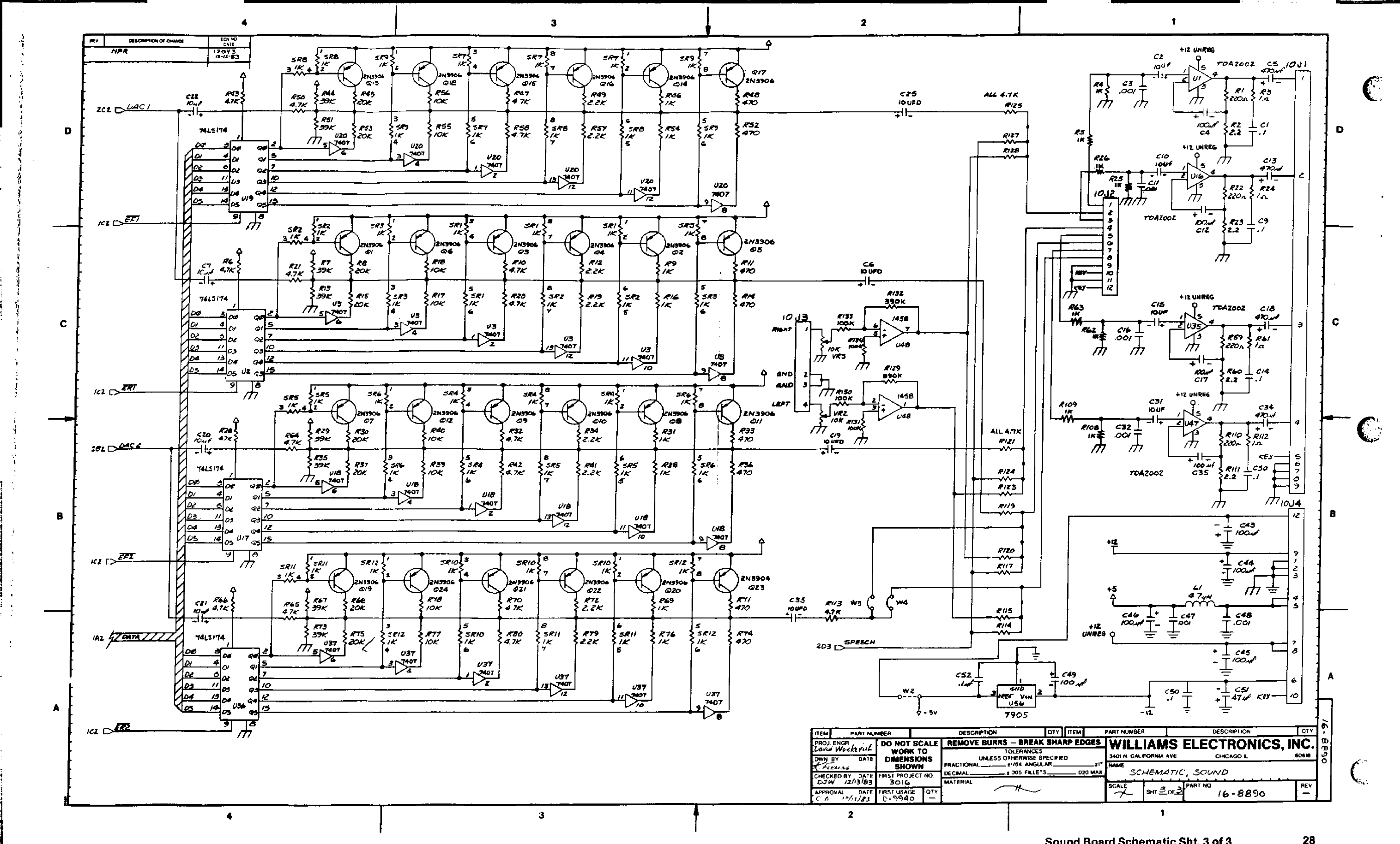
BILL OF MATERIALS

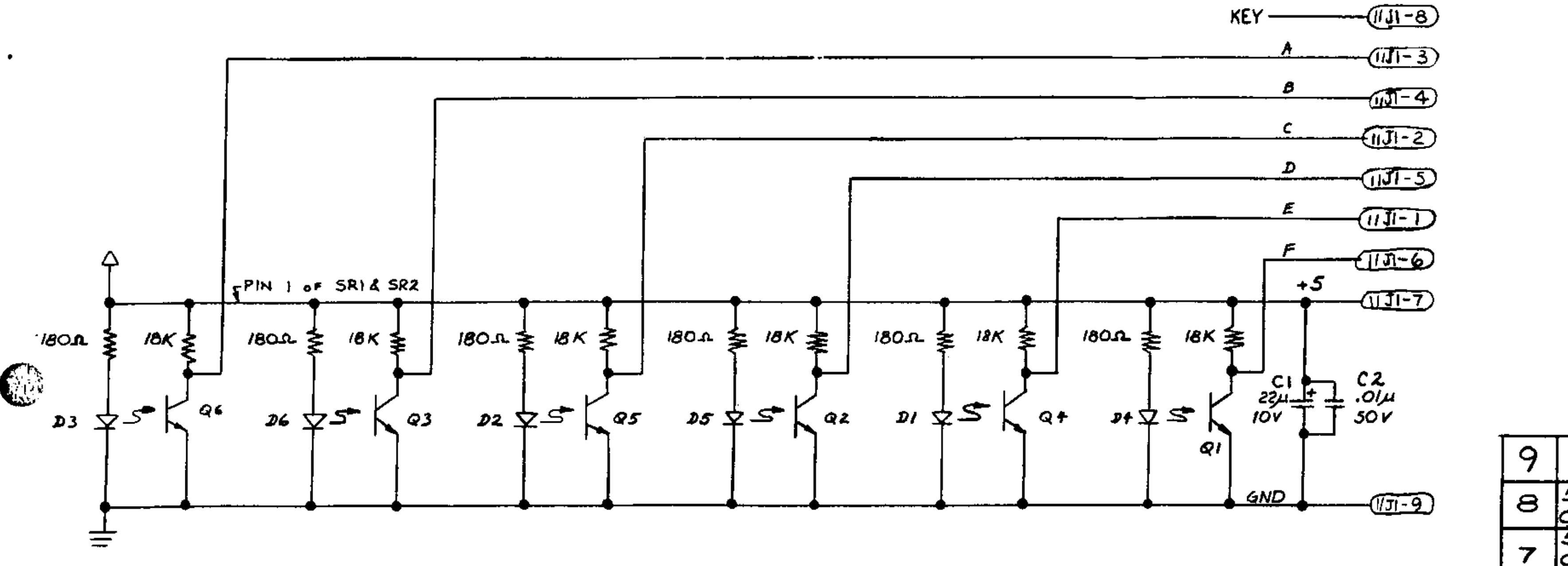


D-9941 Sound Assembly Sht. 2 of 2


WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618
SCHEMATIC, SOUND
16-8890
SHT 1 OF 3
27128 / 2764
6116
68809E
6821
74164
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES
SOUND TEST SW1
ADDRESS
DATA


NOT USED
WILLIAMS ELECTRONICS, INC.
3401 N CALIFORNIA AVE CHICAGO IL 60618
SCHEMATIC, SOUND
16-8690
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES

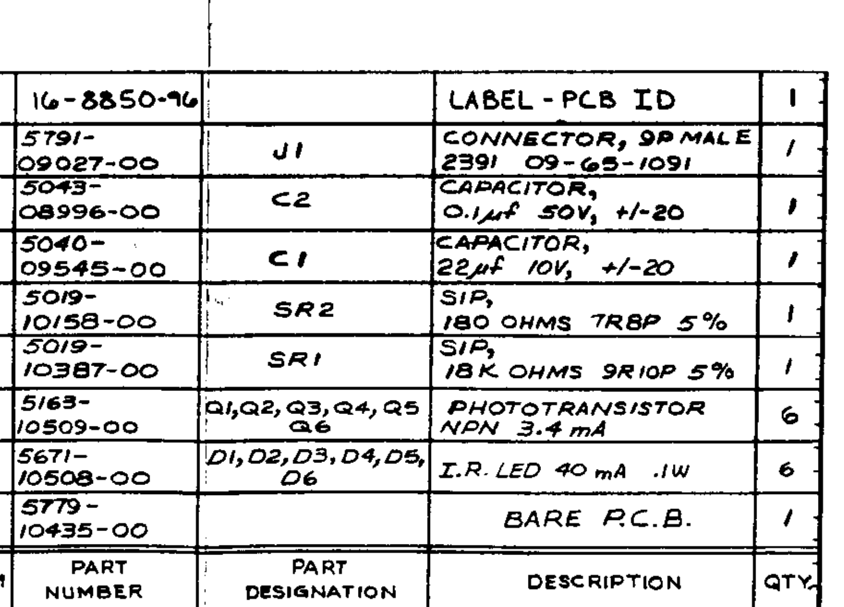

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618
NAME SCHEMATIC, SOUND
SHT 3 OF 3
PART NO 16-8890
DO NOT SCALE WORK TO DIMENSIONS SHOWN
REMOVE BURRS – BREAK SHARP EDGES
FIRST PROJECT NO. 3016
FIRST USAGE D-9940
CHECKED BY DJW 12/13/83
NPR 12043 12-15-83
16-8890



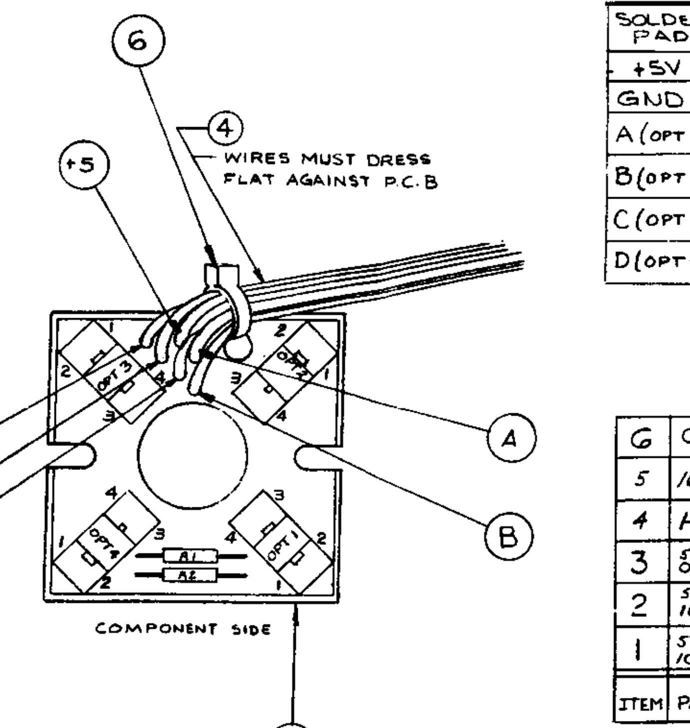
NOTE:

RESISTORS ARE IN SIPS.

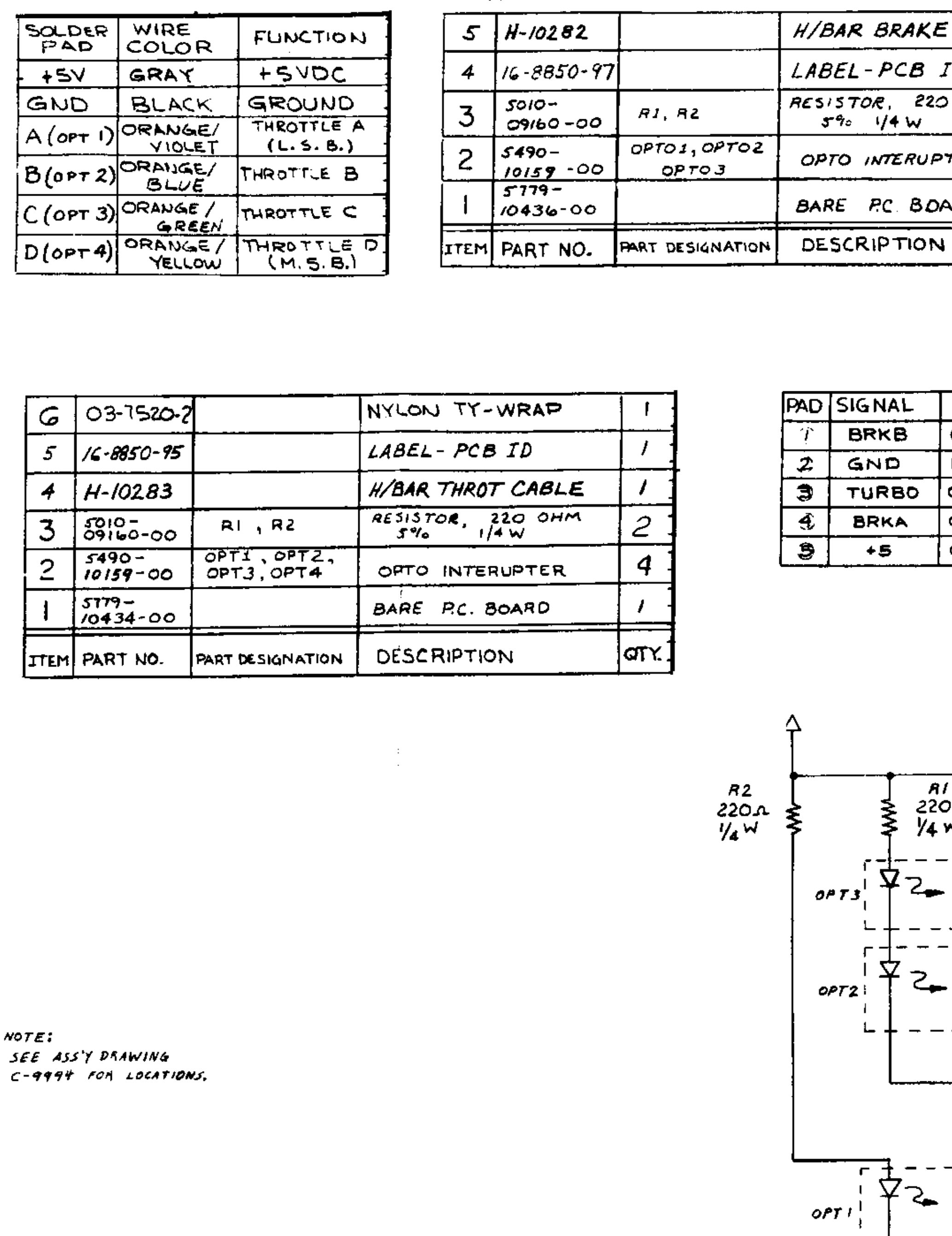
SR2	180Ω
SR1	18K



ITEM	PART NUMBER	PART DESIGNATION	DESCRIPTION	QTY.
9	16-8850-96		LABEL-PCB ID	1
8	5791-09027-00	J1	CONNECTOR, 9P MALE 2391 09-65-1091	1
7	5043-08996-00	C2	CAPACITOR, 0.1µf 50V, +/-20	1
6	5040-09545-00	C1	CAPACITOR, 22µf 10V, +/-20	1
5	5019-10158-00	SR2	SIP, 180 OHMS 7R8P 5%	1
4	5019-10387-00	SR1	SIP, 18K OHMS 9R10P 5%	1
3	5163-10509-00	Q1,Q2,Q3,Q4,Q5 Q6	PHOTOTRANSISTOR NPN 3.4 mA	6
2	5671-10508-00	D1,D2,D3,D4,D5, D6	I.R. LED 40 mA .1W	6
1	5779-10435-00		BARE P.C.B.	1

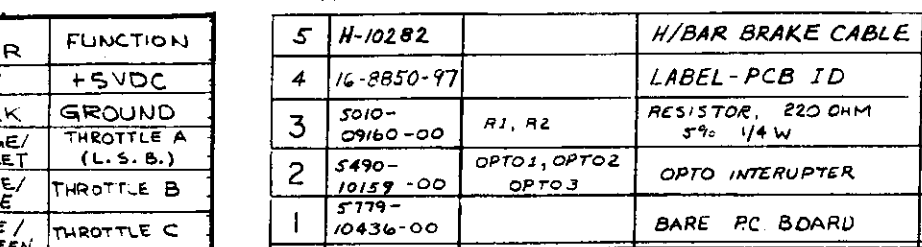


SOLDER PAD	WIRE COLOR	FUNCTION
+5V	GRAY	+5VDC
GND	BLACK	GROUND
A (OPT 1)	ORANGE/ VIOLET	THROTTLE A (L.S.B.)
B (OPT 2)	ORANGE/ BLUE	THROTTLE B
C (OPT 3)	ORANGE/ GREEN	THROTTLE C
D (OPT 4)	ORANGE/ YELLOW	THROTTLE D (M.S.B.)

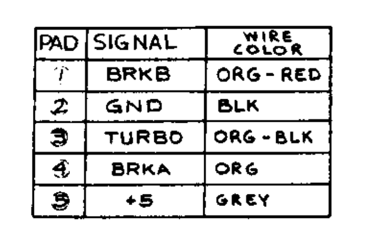


ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
G	03-7520-2		NYLON TY-WRAP	1
5	16-8850-95		LABEL- PCB ID	1
4	H-10283		H/BAR THROT CABLE	1
3	5010-09160-00	R1, R2	RESISTOR, 220 OHM 5% 1/4 W	2
2	5490-10159-00	OPT1, OPT2, OPT3, OPT4	OPTO INTERUPTER	4
1	5779-10434-00		BARE P.C. BOARD	1

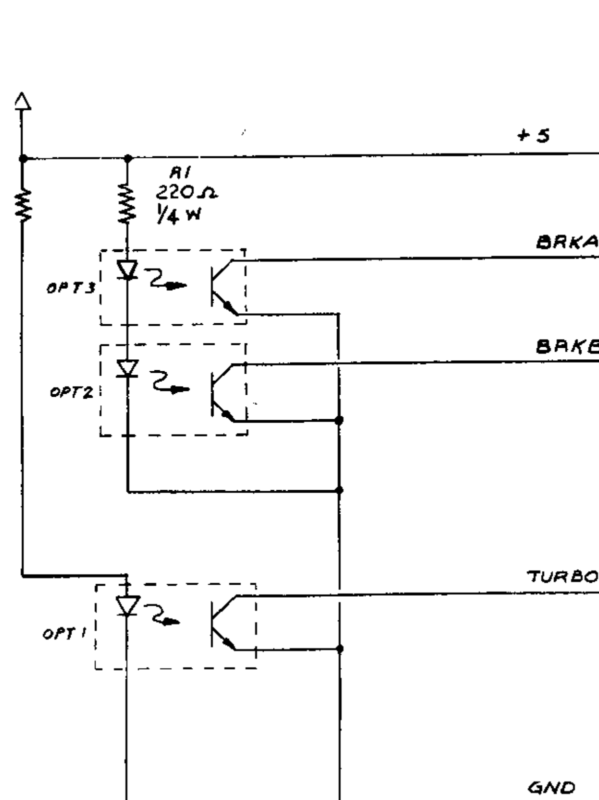
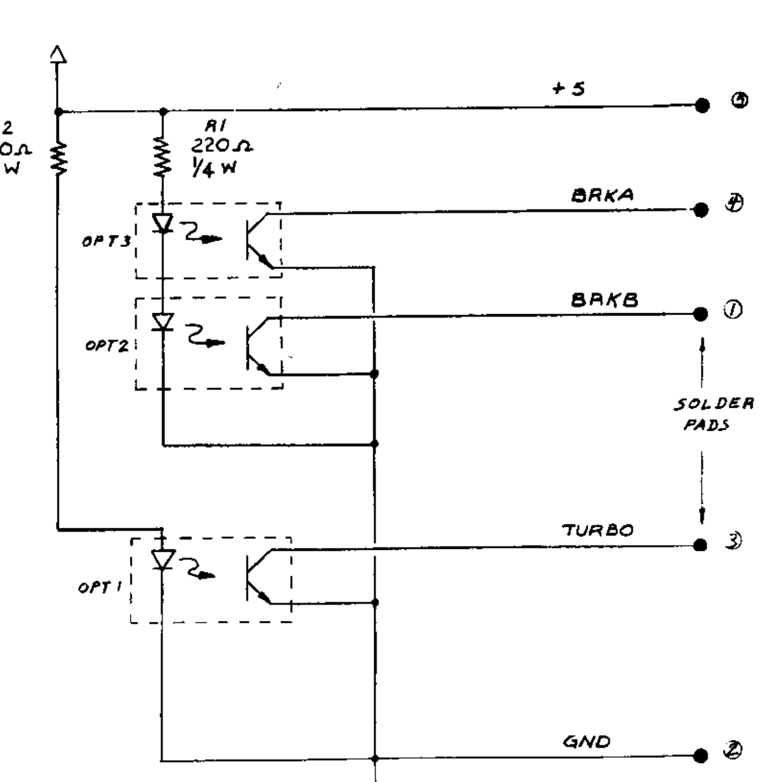
NOTE:
SEE ASS'Y DRAWING
C-9994 FOR LOCATIONS.



ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	QTY.
5	H-10282		H/BAR BRAKE CABLE	1
4	16-8850-97		LABEL-PCB ID	1
3	5010-09160-00	R1, R2	RESISTOR, 220 OHM 5% 1/4 W	2
2	5490-10159-00	OPTO1, OPTO2 OPTO3	OPTO INTERUPTER	3
1	5779-10436-00		BARE P.C. BOARD	· 1

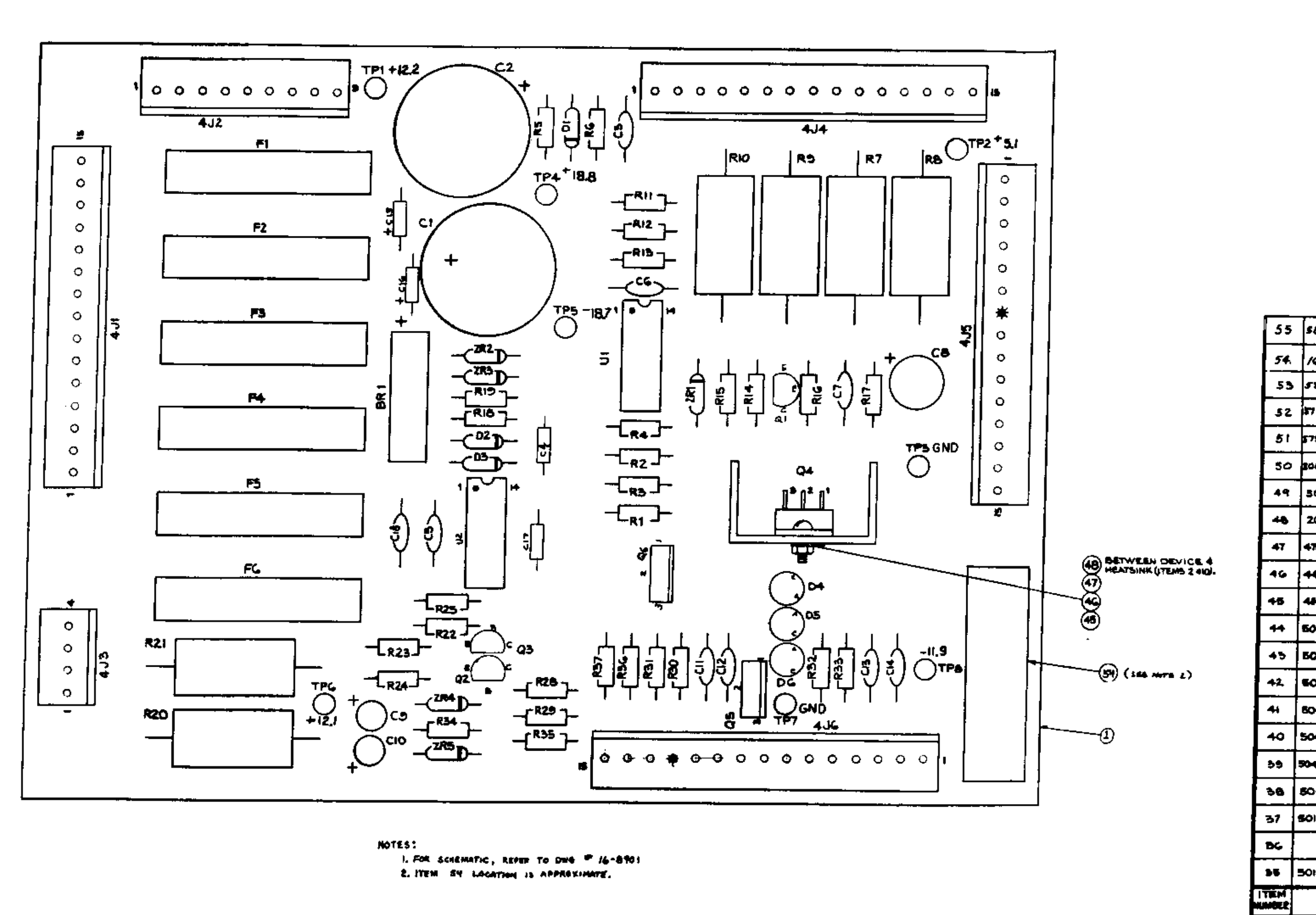


PAD	SIGNAL	WIRE COLOR
1	BRKB	ORG-RED
2	GND	BLK
3	TURBO	ORG-BLK
4	BRKA	ORG
5	+5	GREY

C-9994 Throttle OPTO Assembly and Schematic

C-9996 Brake OPTO Assembly and Schematic



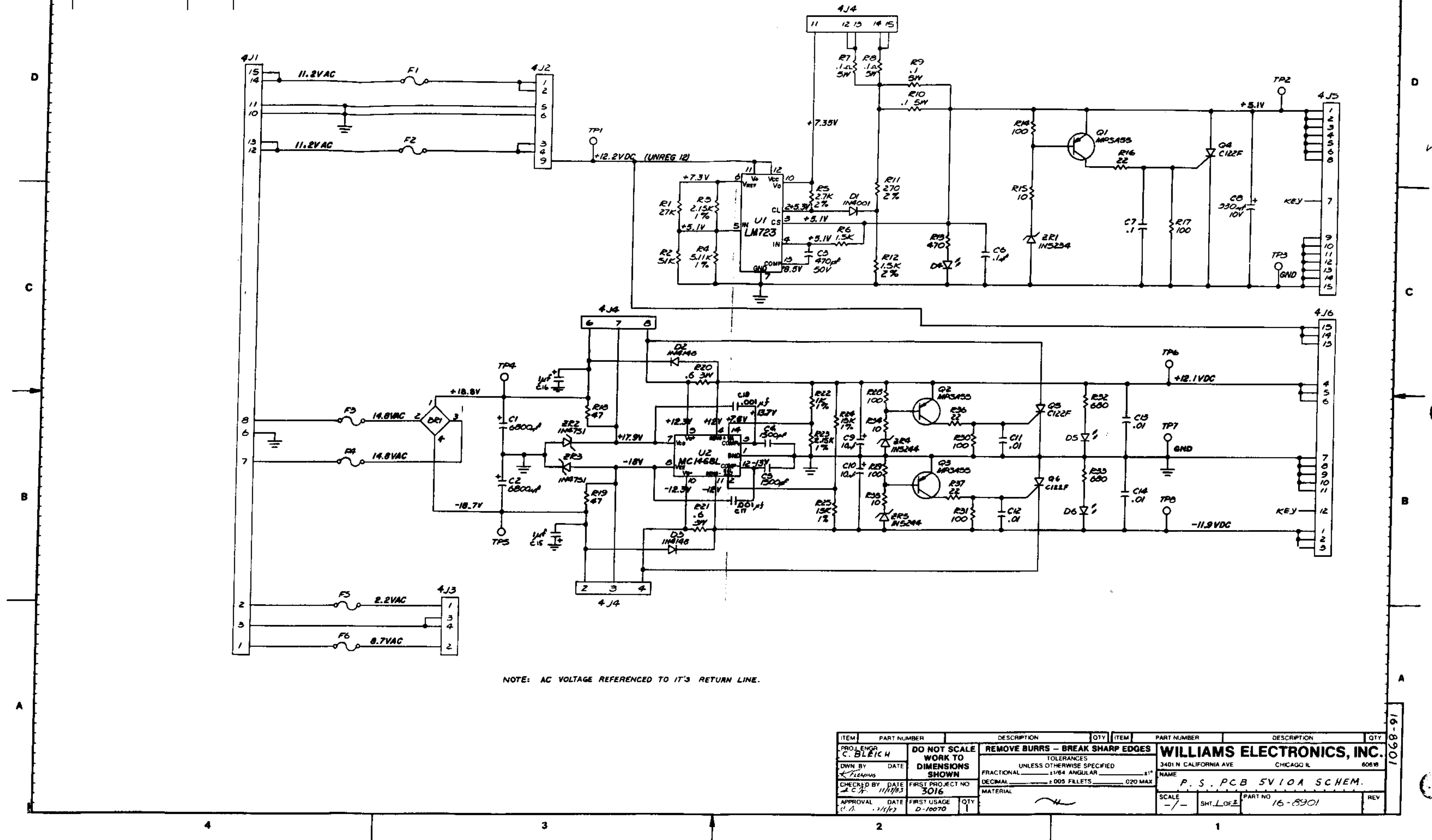
NOTES:
1. FOR SCHEMATIC, REFER TO DWG # 16-8901
2. ITEM 59 LOCATION IS APPROXIMATE.

ITEM	PART NUMBER	DESCRIPTION	DESIGNATION	QTY
15	5040-10488-00	CAP 47,000 µF 25V 150-10		1
14	HW-30018-23	WIRE 18AWG RED/ORG		6"
13	RM-23-07	HS TUBING 1.0" POLY		2"
12	03-7520-2	NYLON TY-WRAP		1
11	5825-06523-00	SLD LG 2102-8		2
10	5705-10630-00	H/SINK 11.5/8 TO-3		1
9	5701-09652-00	THERMAL PAD TO-3		5
8	5700-09445-00	SOCKET, TRANS TO-3		5
7	5151-10491-00	TRANS MJ2955 PNP	Q9	1
6	5162-09425-00	TRANS 2N6057 NPN	Q8,Q7	2
5	5161-09552-00	TRANS 2N3055 NPN	Q10	1
4	5100-10008-00	BRDG 30 RECT 100V	BR2	1
3	4006-01003-10	MS 6-32 x 5/8 P-PH-S		10
2	RM-23-05	HS TUBING 3/16 DIA.		2.5"
1	H-10281	VD H/SINK & CAP CBL		1

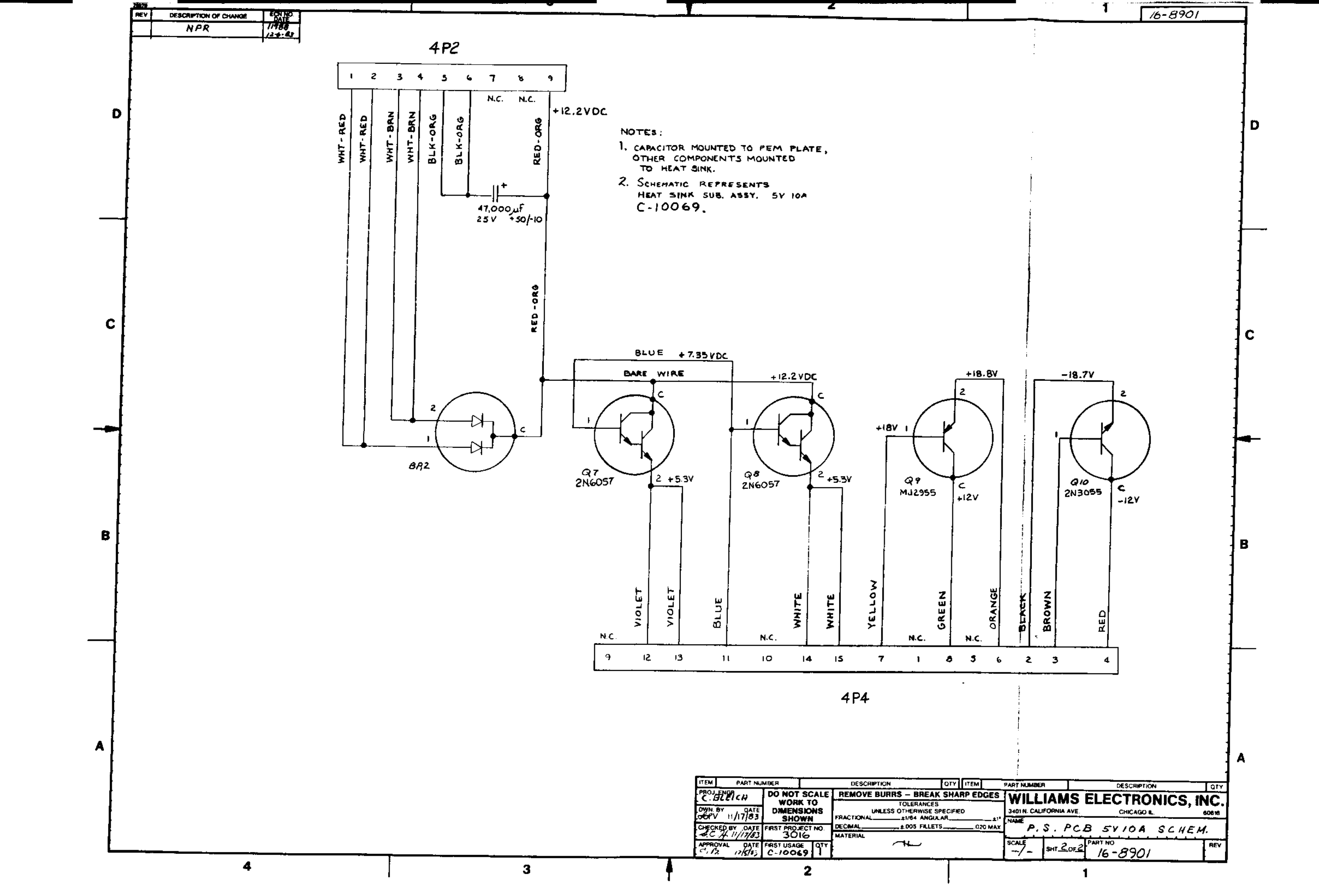
HEAT SINK D-10063 BILL OF MATERIAL

ITEM NUMBER	PART NUMBER	PART DESIGNATION	DESCRIPTION	NUMBER REQ'D.
55	5824-09848-00	TP1-TP8	TEST POINT # 1502-2	8
54	16-8850-98		LABEL-PCB ID	1
53	5731-10597-00	F1,2	FUSE, SB15A 32V	2
52	5731-09432-00	F5,6	FUSE, SB7A 250V	2
51	5791-08665-00	F3,4	FUSE, SB 2A 250V	2
50	5043-09848-00	C17,C18	CAP, .001µf 50V ±20%/	2
49	5041-09031-00	C15,C16	CAP, 1µf 25V ±20%	2
48	20-3225	———	THERMAL COMPOUND	A.R.
47	4703-00007-00	———	#6 EXT. TOOTH LOCKWASHER	1
46	4406-01117-00	———	6-32 HEX NUT	1
45	4406-01003-06	———	6-32X⅜ P-PHS SCREW	1
44	5043-08980-00	C11,C12,C13,C14	CAPACITOR, .01µf	4
43	5040-09777-00	C9,C10	CAPACITOR, 10µf, 20V, 20%	2
42	5040-09423-00	C8	CAPACITOR, 330µf, 10V	1
41	5043-09446-00	C6,C7	CAPACITOR, .1µf-50V +80% -20%	2
40	5048-10488-00	C4,C5	CAPACITOR, 1500PF, CERAMIC	2
39	5048-09068-00	C3	CAPACITOR, 470PF, 50V	1
38	5040-10487-00	C1,C2	CAPACITOR, 6800µf/25V	2
37	5010-09038-00	R32,R33	RESISTOR, 680Ω, 5%, 1/4W	2
36				
35	5013-10486	R24,R26	RESISTOR, 15K, 1%, 1/4W	2
34				
33	5013-10484-00	R22	RESISTOR, 1K, 1%, 1/4W	1
32	5012-10483-00	R20,R21	RESISTOR, .6Ω, 5%, 3W	2
31	5010-10170-00	R18,R19	RESISTOR, 47Ω, 5%, 1/4W	2
30	5010-09454-00	R16,R36,R37	RESISTOR, 22Ω, 5%, 1/4W	3
29	5010-09085-00	R15,R34,R35	RESISTOR, 10Ω, 5%, 1/4W	3
28	5010-09044-00	R14,R17,R28,R29,R30,R31	RESISTOR, 100Ω, 5%, 1/4W	6
27	5010-09416-00	R13	RESISTOR, 470Ω, 5%, 1/4W	1
26	5010-09428-00	R12	RESISTOR, 1.5K, 2%, 1/4W	1
25	5010-09808-00	R11	RESISTOR, 220Ω, 2%, 1/4W	1
24	5012-10005-00	R7,R8,R9,R10	RESISTOR, .1Ω, 5%, 5W	4
23	5010-09088-00	R6	RESISTOR, 1.5K, 5%, 1/4W	1
22	5010-09841-00	R5	RESISTOR, 2.7K, 2%, 1/4W	1
21	5013-09665-00	R4	RESISTOR, 5.11K, 1%, 1/4W	1
20	5013-09420-00	R3/R23	RESISTOR, 2.18K, 1%, 1/4W	2
19	5010-09682-00	R2	RESISTOR, 51K, 5%, 1/4W	1
18	5010-09924-00	R1	RESISTOR, 27K, 5%, 1/4W	1
17	5100-09815-00	BR1	BRIDGE RECTIFIER, 4A	1
16	5075-09662-00	ZR4,ZR5	DIODE, ZENER, 1N5244	2
15	5075-10450-00	ZR2,ZR3	DIODE, ZENER, 1N4731	2
14	5075-09406-00	ZR1	DIODE, ZENER, 1N5234	1
13	5671-09015-00	D4,D5,D6	DIODE, LED	3
12	5070-08815-00	D2,D3	DIODE, SILICON, 1N4148	2
11	5070-06258-00	D1	DIODE, SILICON, 1N4001	1
10	5150-09661-00	Q4,Q5,Q6	SCR, C122F	3
9	5150-08430-00	Q1,Q2,Q3	TRANSISTOR, PNP, MPSA55	3
8	5250-10432-00	U2	MC14GBL #15V REGULATOR	1
7	5460-09424-00	U1	723 VOLTAGE REGULATOR	1
6	5751-10326-00	J1,J4,J5,J6	HEADER, CONNECTOR, 15 PIN	4
5	5751-10599-00	J2	HEADER, CONNECTOR, 9 PIN	1
4	5751-10598-00	J3	HEADER, CONNECTOR, 4 PIN	1
3	5782-09178-00	———	FUSE HOLDER	12
2	5705-09155-00	———	HEAT SINK	1
1	5773-10482-00	———	P.C. BOARD	1

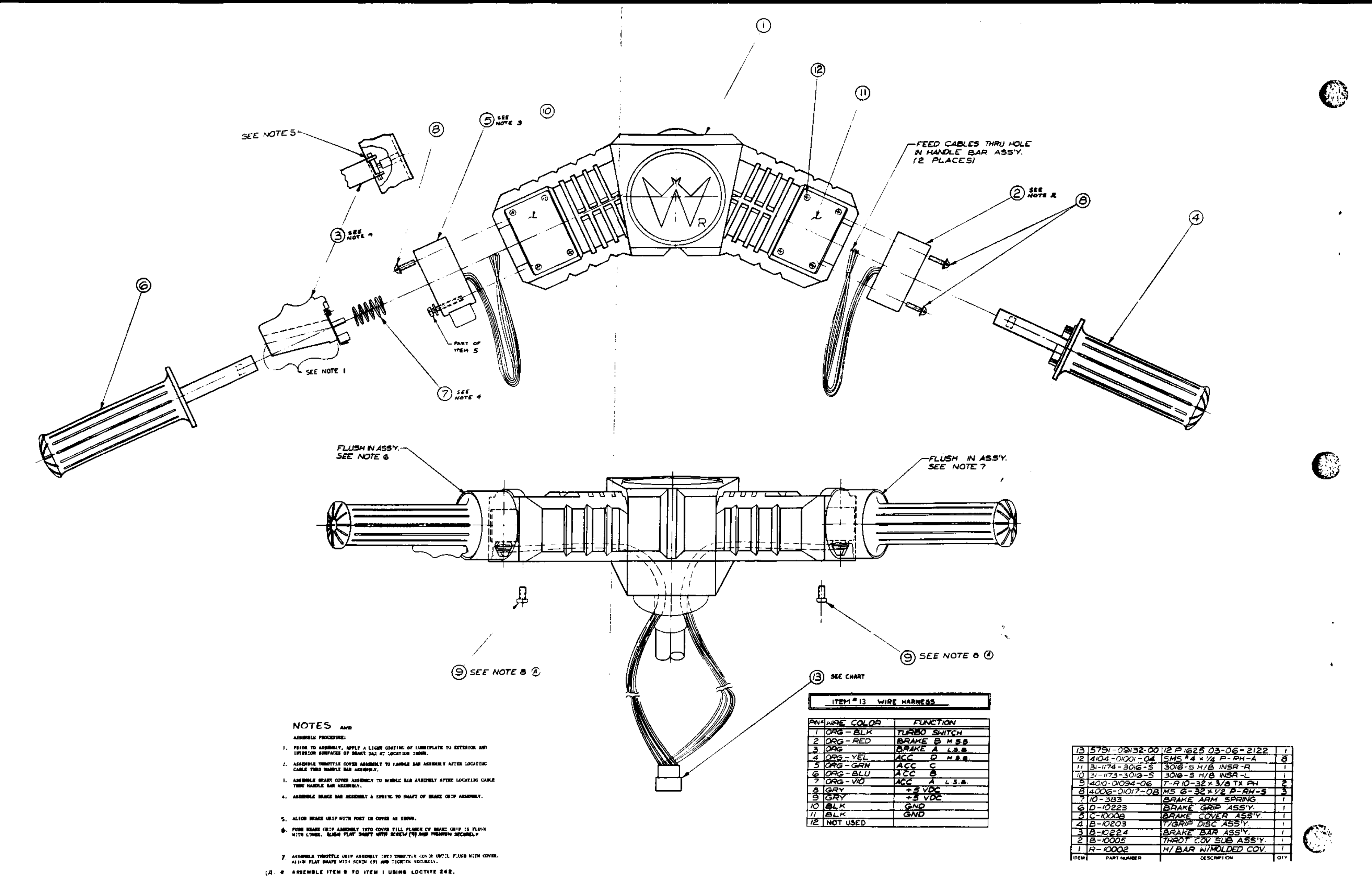
•BILL OF MATERIALS•



REV
DESCRIPTION OF CHANGE
ECN NO DATE
NPR
11988
4J1
11.2VAC
F1
4J2
F2
TP1
+12.2VDC (UNREG 12)
4J4
R7 .1Ω 5W
R8 .1Ω 5W
R9 .1 5W
R10 .1 5W
+7.35V
+7.3V
R1 27K
R3 2.15K 1%
+5.1V
R2 51K
R4 5.11K 1%
U1 LM723
R5 2.7K 2%
D1 1N4001
R6 1.5K
+5.1V
C3 470µf 50V
8.5V
R11 270 2%
R12 1.5K 2%
R13 470
D4
C6 .1µf
R14 100
Q1 MPSA55
R15 10
ZR1 1N5234
R16 22
C7 .1
R17 100
Q4 C122F
C8 330µf 10V
+5.1V
TP2
4J5
KEY
TP3
GND
4J6
TP4
+18.8V
F3
14.8VAC
BR1
F4
14.8VAC
C1 6800µf
C2 6800µf
-18.7V
TP5
C16 1µf
C15 1µf
R18 47
R19 47
ZR2 1N4751
ZR3 1N4751
+17.9V
-18V
D2 1N4148
D3 1N4148
R20 .6 3W
R21 .6 3W
+12.3V
+12V
+7.8V
+13.7V
C18 .001µf
U2 MC1468L
-12.3V
-12V
12-13V
C4 1500pf
C5 1500pf
C17 .001µf
R22 15K 1%
R23 2.15K 1%
R24 15K 1%
R25 15K 1%
C9 10µf
C10 10µf
R26 100
R27 100
R34 10
R35 10
ZR4 1N5244
ZR5 1N5244
Q2 MPSA55
Q3 MPSA55
R36 22
R37 22
R30 100
R31 100
C11 .01
C12 .01
Q5 C122F
Q6 C122F
R32 680
R33 680
D5
D6
C13 .01
C14 .01
TP6
+12.1VDC
TP7
GND
TP8
-11.9VDC
F5
2.2VAC
F6
8.7VAC
4J3
NOTE: AC VOLTAGE REFERENCED TO IT'S RETURN LINE.
ITEM
PART NUMBER
DESCRIPTION
QTY
PROJ. ENGR. C. BLEICH
DWN BY
DATE
CHECKED BY
11/17/83
APPROVAL
DO NOT SCALE WORK TO DIMENSIONS SHOWN
FIRST PROJECT NO 3016
FIRST USAGE D-10070
REMOVE BURRS – BREAK SHARP EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ±.005 FILLETS .020 MAX
MATERIAL
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE
CHICAGO IL
60618
NAME
P. S. PCB 5V 10A SCHEM.
SCALE
-/-
SHT 1 OF 2
PART NO
16-8901
REV
16-8901



REV
DESCRIPTION OF CHANGE
ECN NO DATE
NPR
17188 12-6-83
16-8901
4P2
1 2 3 4 5 6 7 8 9
N.C. N.C.
+12.2VDC
WHT-RED
WHT-RED
WHT-BRN
WHT-BRN
BLK-ORG
BLK-ORG
RED-ORG
47,000µf 25V +50/-10
RED-ORG
NOTES:
1. CAPACITOR MOUNTED TO PEM PLATE, OTHER COMPONENTS MOUNTED TO HEAT SINK.
2. SCHEMATIC REPRESENTS HEAT SINK SUB. ASSY. 5V 10A C-10069.
BR2
BLUE +7.35VDC
BARE WIRE
+12.2VDC
+18.8V
-18.7V
Q7 2N6057
2 +5.3V
Q8 2N6057
2 +5.3V
+18V 1
Q9 MJ2955
C +12V
Q10 2N3055
C -12V
N.C.
VIOLET
VIOLET
BLUE
N.C.
WHITE
WHITE
YELLOW
N.C.
GREEN
N.C.
ORANGE
BLACK
BROWN
RED
9 12 13 11 10 14 15 7 1 8 5 6 2 3 4
4P4
ITEM
PART NUMBER
DESCRIPTION
QTY
PROJ. ENGR C. BLEICH
DWN. BY DATE 11/17/83
CHECKED BY DATE 11/17/83
APPROVAL DATE
DO NOT SCALE WORK TO DIMENSIONS SHOWN
FIRST PROJECT NO 3016
FIRST USAGE C-10069
QTY 1
REMOVE BURRS – BREAK SHARP EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ±.005 FILLETS .020 MAX
MATERIAL
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL 60618
NAME P.S. PCB 5V10A SCHEM.
SCALE -/-
SHT 2 OF 2
PART NO 16-8901
REV



NOTES AND

ASSEMBLE PROCEDURE:

1. PRIOR TO ASSEMBLY, APPLY A LIGHT COATING OF LUBRIPLATE TO EXTERIOR AND INTERIOR SURFACES OF BRAKE BAR AT LOCATION SHOWN.
2. ASSEMBLE THROTTLE COVER ASSEMBLY TO HANDLE BAR ASSEMBLY AFTER LOCATING CABLE THRU HANDLE BAR ASSEMBLY.
3. ASSEMBLE BRAKE COVER ASSEMBLY TO HANDLE BAR ASSEMBLY AFTER LOCATING CABLE THRU HANDLE BAR ASSEMBLY.
4. ASSEMBLE BRAKE BAR ASSEMBLY & SPRING TO SHAFT OF BRAKE GRIP ASSEMBLY.
5. ALIGN BRAKE GRIP WITH POST IN COVER AS SHOWN.
6. PUSH BRAKE GRIP ASSEMBLY INTO COVER TILL FLANGE OF BRAKE GRIP IS FLUSH WITH COVER. ALIGN FLAT SHAFT WITH SCREW (9) AND TIGHTEN SECURELY
7. ASSEMBLE THROTTLE GRIP ASSEMBLY INTO THROTTLE COVER UNTIL FLUSH WITH COVER. ALIGN FLAT SHAFT WITH SCREW (9) AND TIGHTEN SECURELY.

(A) 8 ASSEMBLE ITEM 9 TO ITEM 1 USING LOCTITE 242.

ITEM # 13 WIRE HARNESS

PIN #	WIRE COLOR	FUNCTION
1	ORG - BLK	TURBO SWITCH
2	ORG - RED	BRAKE B M.S.B.
3	ORG	BRAKE A L.S.B.
4	ORG - YEL	ACC D M.S.B.
5	ORG - GRN	ACC C
6	ORG - BLU	ACC B
7	ORG - VIO	ACC A L.S.B.
8	GRY	+5 VDC
9	GRY	+5 VDC
10	BLK	GND
11	BLK	GND
12	NOT USED	

ITEM	PART NUMBER	DESCRIPTION	QTY
13	5791-09132-00	12 P 1625 03-06-2122	1
12	4104-01001-04	SMS #4 x 1/4 P-PH-A	8
11	31-1174-3016-S	3016-S H/B INSR-R	1
10	31-1173-3016-S	3016-S H/B INSR-L	1
9	4010-01094-06	T-R 10-32 x 3/8 TX PH	2
8	4006-01017-08	MS 6-32 x 1/2 P-RH-S	3
7	10-383	BRAKE ARM SPRING	1
6	D-10223	BRAKE GRIP ASS'Y.	1
5	C-10009	BRAKE COVER ASS'Y.	1
4	B-10203	T/GRIP DISC ASS'Y.	1
3	B-10224	BRAKE BAR ASS'Y.	1
2	B-10005	THROT COV SUB ASS'Y.	1
1	R-10002	H/ BAR W/MOLDED COV.	1